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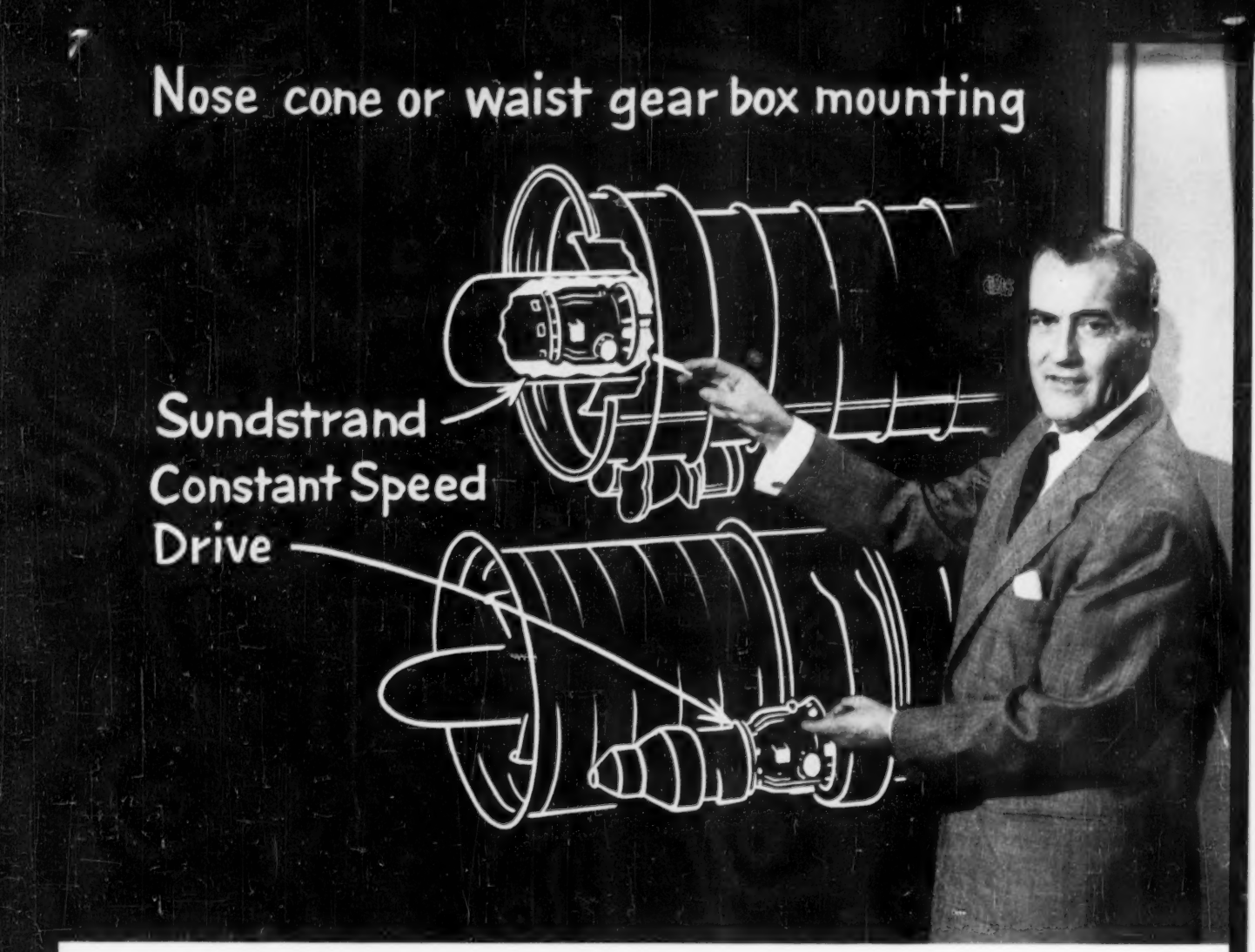
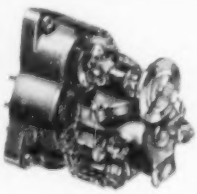
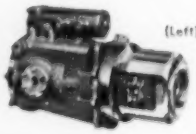


How Sundstrand helps solve design problems



(Left) "Package-Type" Drive — can be strut or bracket mounted in line with power take-off pad.

(Right) "Sandwich-Type" Drive — extremely compact for mounting in nose cone, or other available pad.



(Left) "Cartridge-Type" Drive — mounts within engine gear box.

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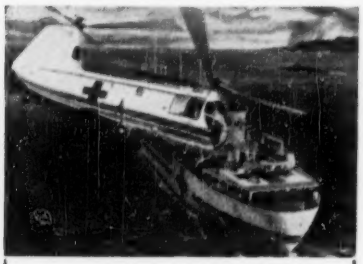

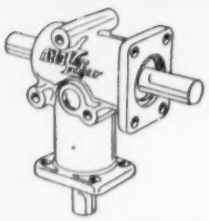

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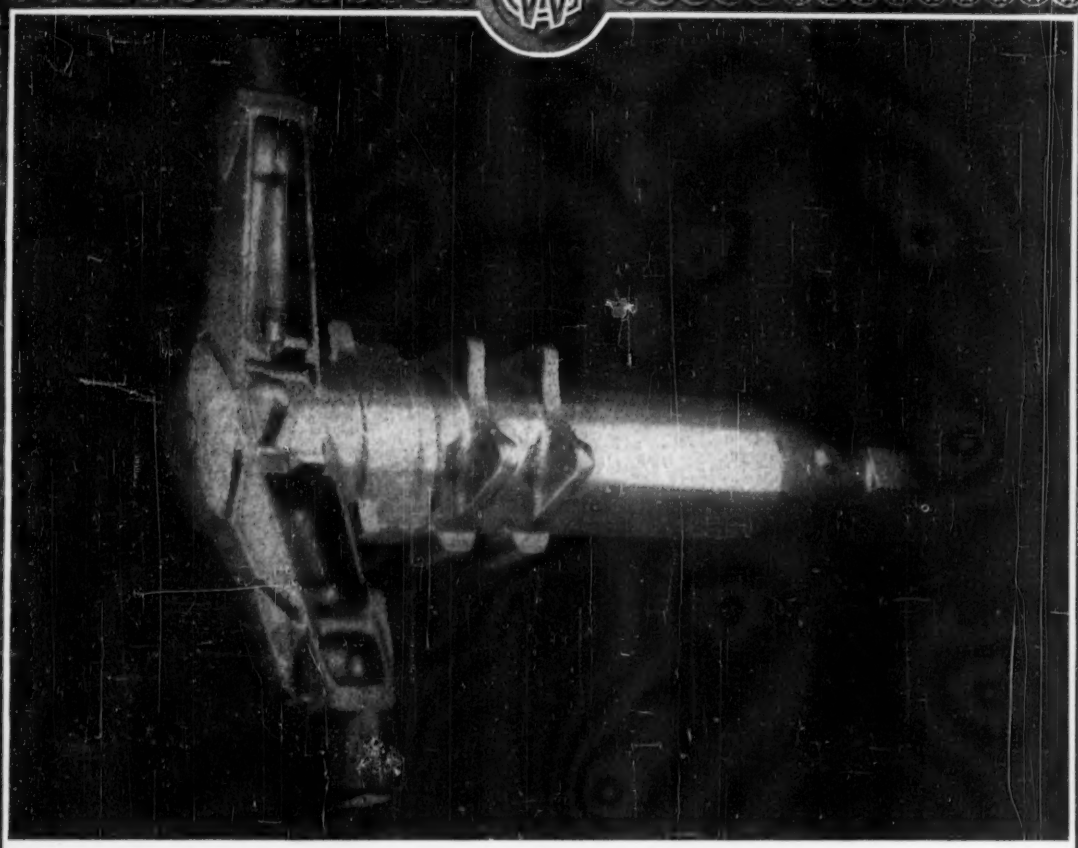

Forgings for the aircraft industry today demand the utmost in engineering and production techniques and in scientific laboratory control. This massive complicated landing gear component, weighing over 400 pounds, is typical of Wyman-Gordon's forging contribution to the ever-growing progress in aircraft design. In crankshafts for the automotive industry and in all types of aircraft forgings, steel and light alloy, Wyman-Gordon has pioneered in the development of forging "know-how"—there is no substitute for Wyman-Gordon experience.

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NEWS DIGEST

Domestic

Sikorsky S-56 twin-engine Marine assault helicopter was airborne for the first time Dec. 18 and made a low-altitude flight of about 15-min. duration Dec. 21. The copter has a five-blade main rotor and a stub wing to unload the rotor during highspeed forward flight.

Failure of a portion of the turbine in the No. 2 Wright Turbo Compound engine of an American Airlines DC-7 during start of takeoff Dec. 21 caused the flight to be canceled. The turbine failure set off the transport's fire warning system, and the pilot halted the plane with brakes and reversible props. There was no visible fire. All 59 passengers and five crew members were evacuated. The DC-7 had been delayed two hours prior to takeoff because fire warning system in the No. 3 engine did not respond to pre-flight tests. A Wright Aeronautical spokesman declined comment on the incident, but said company engineers were investigating.

United Air Lines gives strong backing to a new 5.7-cm. wavelength (C-band) over older 3-cm. (X-band) for use in airborne weather warning radar. This first official company statement on UAL's evaluation of tests of an experimental RCA radar confirms an AVIATION WEEK prediction (Sept. 28, p. 84). Detailed UAL report on the radar is expected within a month.

New overseas flights from Detroit and Chicago to London will be inaugurated by Pan American World Airways Apr. 30, flying Douglas DC-6 transports on the weekly service. PAA plans to expand routes from the Midwest cities next June with flights to Prestwick, Scotland; Hamburg, Germany; Copenhagen and Stockholm.

Record traffic of more than 3 million passengers is predicted by Trans World Airlines for 1953, topping last year's total by higher than 20%. TWA reports preliminary figures indicate an increase of nearly 24% in revenue passenger miles, with tourist services being credited with the sharpest climb of 103.3%.

William B. Ziff, 55, pioneer aviator and board chairman of Ziff-Davis Publishing Co., died last week in New York.

Vice Adm. Charles E. Rosendahl (USN Ret.), long-time proponent of dirigibles, believes the atomic powerplant and titanium may rekindle interest in lighter-than-air craft. He envisions the airship as most practical for lifting heavy nuclear engines and isolating crews from danger of radiation. Rosendahl told the New York Chapter of Aviation Writers Assn. he believes lightweight titanium can replace fabric as covering for airships to increase their strength.

Eisenhower Awards Aviation Trophies

President Eisenhower (second from right) chats with P&WA executive engineer Leonard S. Hobbs (second from left) following presentation of top aviation awards for 1953 at the Wright Memorial Dinner in Washington, D. C., Dec. 17. From left to right: Dr. Leslie Bryan, University of Illinois, winner of the Frank C. Brewer Trophy for aviation training and education achievements; Hobbs, winner of the Collier Trophy for his work on the J57 turbojet; Harry Coffey, president of the National Aeronautic Assn.; Eisenhower, and Rep. Carl Hinshaw, winner of the Wright Brothers Memorial Trophy. (Story on Wright Dinner on p. 16.)

Aviation gas lead content is being cut from 4 to 3 cc. by Esso Standard Oil Co. in fuel grades 91/98 and 100/130, a move intended to reduce lead fouling effect.

Financial

McDonnell Aircraft Co., St. Louis, reports peak backlog of $528 million, expects this production volume to increase its work force by approximately 5,000 persons within the next 18 months.

Emery Air Freight Corp., has declared a semi-annual dividend of 10 cents per share, payable Jan. 4 to stockholders of record Dec. 11.

International

First Hawker Hunter Mk. 2 to roll off assembly lines at Armstrong Whitworth Aircraft's Coventry plant has completed flight tests.

Uri Michaely, Israel's director of civil aviation, is looking over U. S. helicopters during a three-month study tour sponsored by International Civil Aviation Organization. Copters would be used for spraying purposes, Michaely says.

Trans-Australia Airlines reports a profit of approximately $307,000 for its last fiscal year, compared with a loss of $167,000 during the previous 12-month period. Gross revenues for the year: more than $16.8 million.

Bristol Type 173 twin-engine, twin-rotor helicopter has completed a series of tests on the HMS Eagle, Britain's largest aircraft carrier. Purpose of the trial was to collect data on copter behavior under varying conditions of deck motion. Tests were made by Bristol Aeroplane Co. for its own information, with the Royal Navy acting as a co-operating agency.

Air traffic transactions put through International Air Transport Assn.'s London clearing house set record totals of $23,884,000 in September and $23,625,000 in October, IATA reports. Cumulative turnover during the first 10 months of 1953: $201,670,000.

French civil aviation development will require new investments totaling approximately $371 million during the next five years, reports Rene Lemaire, secretary-general for civil and commercial aviation in France.

KAMAN HOK-1, the newest Navy high-performance helicopter is designed for general utility service and converts to an aerial ambulance. Schweizer Aircraft Corp. gives Kaman a production assist in the building of this most versatile helicopter.

The Schweizer reputation for quality standards, production ability and the facilities for both sub-contract work and the manufacture of Schweizer's internationally famous sailplanes is widely recognized and relied upon.

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ELMIRA, NEW YORK

The Aviation Week

December 28, 1953

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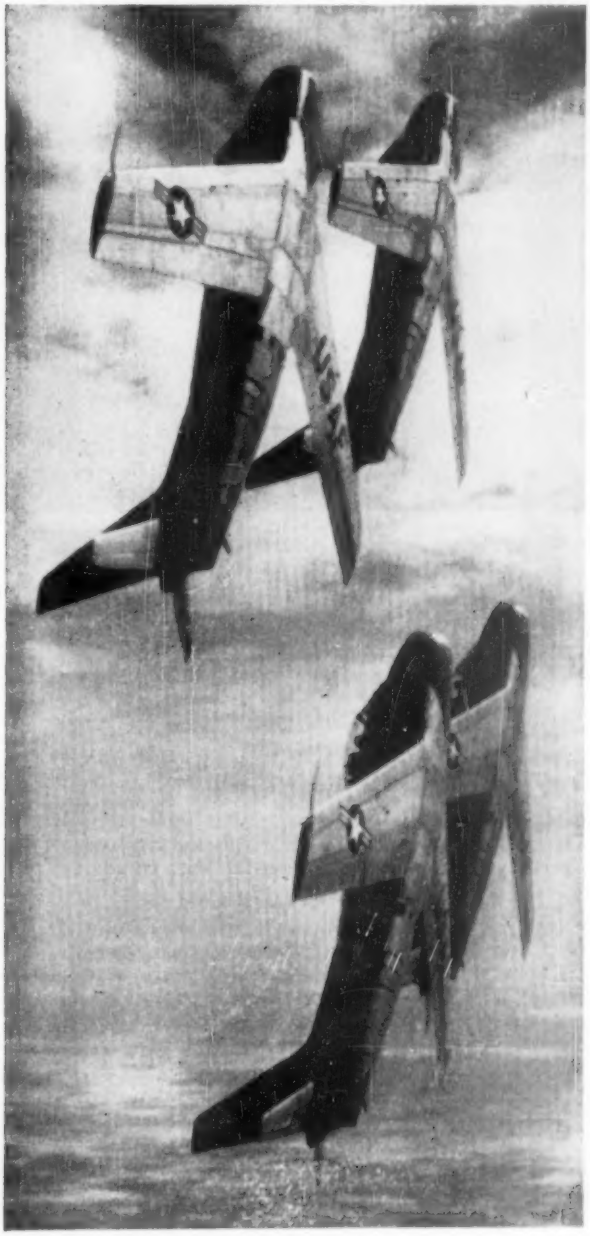
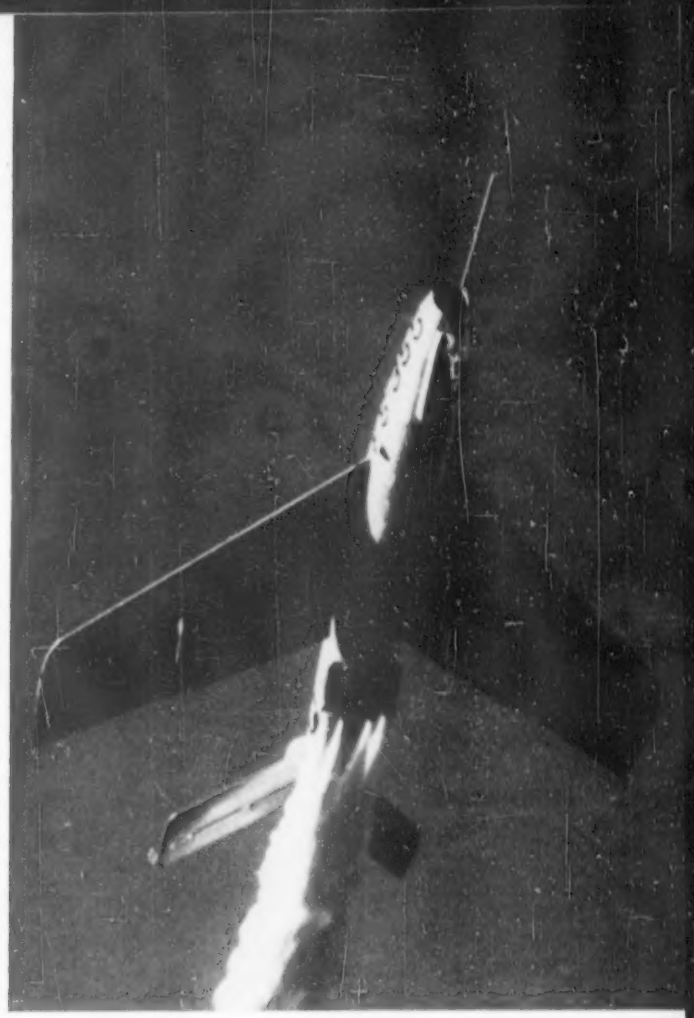
U.S. Jet Fighters Caught on the Wing

These spectacular action photos of the new USAF and Navy jet fighters show four-plane North American F-86 aerobatic team, the Sabre Knights (below), working on a loop in close diamond formation; first view of a Republic F-84F Thunderstreak (top right) being boosted skywards by four powerful rocket assist takeoff units under the plane's belly, and a Chance Vought F7U-3 Cutlass (lower right) coming in for a landing with wing slats open and V-type carrier arresting hook lowered.





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WHO'S WHERE

In the Front Office

J. Kneeland Nunan is new president of Consolidated Vacuum Corp., Rochester, N. Y., subsidiary of Consolidated Engineering Corp.

Robert H. Hernstein has been elected vice president-traffic and sales for Bonanza Airlines.

Matthew J. Betley has been appointed vice president and general manager of Aeroquip Corp., Jackson, Mich.

Gale M. Deam, onetime financial and management consultant at Lockheed Aircraft Corp., has become secretary-treasurer of Resin Industries, Santa Barbara, Calif.

Changes

Frank Sharpe is new general sales manager for Eastern Air Lines.

Dennis J. O'Connell has been appointed manager of A. O. Smith Corp.'s Landing Gear Division, Toledo, Ohio.

Douglas Knowles, former chief engineer of Avro Canada's Gas Turbine Division, has joined Continental Aviation & Engineering Corp. at Detroit as assistant manager of the Turbine Division.

C. T. Reid has become director of public relations for Grand Central Aircraft Co., Glendale, Calif.

Laurence H. Flora has been promoted to sales director for Timerman Products, Cleveland. **Edward E. Griger** is new sales manager.

H. Arthur Hook, longtime airport specialist for CAA, has joined Pereira & Luckman, Los Angeles and New York architects-engineers, as chief of the airports installation department.

M. J. Rudick has been promoted to supervisor of structures materials for Chance Vought Aircraft, Dallas. Other changes: **H. J. Stack,** chief industrial engineer, and **R. H. Lundberg,** assistant chief industrial engineer.

Bruce H. Schwartz is new chief engineer of military products for AC Spark Plug's Milwaukee and Flint, Mich., plants.

Philip J. O'Brien has been appointed wage and salary administrator for Kaman Aircraft Corp.'s industrial relations department, Bloomfield, Conn. Also promoted: **Eugene F. Flynn,** employment manager; **George B. Bullard, Jr.,** supervisor of industrial engineering, and **I. L. Katz,** supervisor of material section.

Honors and Elections

W. A. Patterson, president of United Air Lines, has been appointed by President Eisenhower to the Commission on Judicial and Congressional Salaries.

Gordon W. Reed, board chairman of Glass Fibers, and **Harry O. King,** a director, have received USAF's award for meritorious civilian service for "outstanding services as special consultants."

Wilbur L. Morrison, executive vice president in charge of Pan American World Airways Latin American Division, has been honored by PAA for 25 years of service.

INDUSTRY OBSERVER

► First production model of North American Aviation's FJ-3 with a Wright J65 Sapphire engine has flown at Columbus, O. The Navy model has the old-style slatted leading edge rather than the new 6-3 sweptback wing of the F-86F.

► Douglas Aircraft's proposed turboprop powered C-133 transport still is on paper, according to a company spokesman. The project still is classified.

► General Electric is expected to make a bid to enter the interceptor fire-control field, currently dominated by Hughes Aircraft Co. and Westinghouse's Air Arm Division. GE has been quietly flight testing a completely automatic (closed-loop) system for several years.

► USAF's C-124B Globemaster powered by four Pratt & Whitney Aircraft T34 turboprops is expected to make its first flight at Douglas' Santa Monica plant before the end of the year or shortly thereafter. C-124B is considered a prototype for the C-133.

► Marcel Dassault Mystere 2 with the Snecma Atar 101D turbojet is showing superior performance to the Mystere 4 with Hispano Tay, say French sources. Power increases in the Atar compensate for the higher drag of the older Mystere 2 design. Atar 101D is currently rated at 6,600 lb. sea level static thrust without afterburning.

► American Airlines reportedly is having difficulty meeting its less-than-eight-hour nonstop transcontinental schedule with its new DC-7s because of power drop when the Wright Turbo Compound engines are leaned out to cruise-fuel-consumption. This forces pilots to fly 2,000 ft. lower than the 23,000 ft. originally planned. Another factor is strong winter winds. AA says it is working with Douglas and Wright to find solutions to the problems.

► Boeing B-47s will completely replace B-29s and B-50s in Strategic Air Command's medium bomber wings by the end of 1955, according to Air Force Secretary Talbott. B-52s will be replacing the B-36 as the USAF inter-continental bomber by 1956.

► Convair's Forth Worth Division is adding a beefed-up main landing gear to the B-36, and the plane has been designated the B-36J. The plane will carry a heavier bomb load and the gross weight is more than 400,000 lb.

► Construction of a de Havilland jet Comet simulator is still in the talking stage between Civil Aeronautics Administration and Curtiss-Wright Corp. CAA proposes to install the simulator at its Oklahoma City aeronautical center to familiarize its technical and international staffs with Comet operation prior to the advent of jet transportation in this country. C-W has built such a simulator for British Overseas Airways Corp. under license from de Havilland.

► Renewed effort by the British to put the Gloster Javelin, delta-wing night fighter, in the joint aircraft program for off-shore procurement has delayed progress on the fiscal 1954 program. It was rejected in the fiscal 1953 program. Italy, now producing the F-86K, wants to manufacture U. S. aircraft, feeling that British factories are almost as vulnerable to air attack as continental factories and that it is advisable to equip European forces with U. S. aircraft.

► Watch for Eclipse-Pioneer to announce a radically new autopilot, the PB-20, designed specifically for highspeed jet transports. Design is rumored to feature accelerometers instead of the commonly used gyroscopes.

► Clearance for 3,700-hp. military rating on Turbo Compound engine has been received by Wright Aeronautical Division of Curtiss-Wright Corp. Highest previous announced rating was 3,500. A company spokesman said that weight-horsepower ratio is now 0.92 lb/hp.

► Snecma Vulcan turbojet is expected to reach 11,000-lb. sea level static thrust rating by the end of the year. The French single-compressor engine, which delivered 9,900 lb. thrust during its qualification tests, is in the pre-production stage now. Quantity production is expected early in 1955.

Washington Roundup

Newer Look?

Some airpower leaders on Capitol Hill aren't satisfied that the new Joint Chiefs of Staff have gone far enough in concentrating on airpower and cutting back on surface forces in their "new look" defense program.

They plan to challenge the Administration with its own argument: economy. They complain that the Administration, in its efforts to make the armed services "efficient," is overlooking possibilities of sharply cutting defense spending by developing "effective" forces and cutting deadwood.

They say the taxpayers now are supporting two Defense Departments—one to wage a second World War II and the other to wage an entirely new type of war.

American Airlines' president C. R. Smith expressed the thoughts of the dissidents in his recent Tulsa speech: "An increasing number of thoughtful men are swinging to the belief that there is something wrong with our prevailing approach to strategy, with its emphasis on surface weapons."

A changed approach, he said, would enable a 1-million personnel cutback and a $10-billion-a-year budget reduction. This would mean a 2.5-million total military strength and a $25-billion annual budget. The Administration's program is understood to mean an eventual reduction to 3.1 million personnel and $32-billion or $33-billion budget.

Symington's Converts

Air Force's former Secretary, Sen. Stuart Symington, has won new support during the congressional recess for his airpower fight with Defense Secretary Charles Wilson. One outstanding convert: economy-minded Sen. Paul Douglas who supported the Wilson program and was one of the handful of Democrats who voted against proposals to restore Air Force money this year. Douglas' comment:

"I now publicly confess that I was wrong and that Symington was right. I made the mistake then and I promise that I will not make the same error again. . . ."

Count on Symington to confront Wilson with his assurance that no combat planes would be eliminated from the USAF program and his subsequent cancelation, after Congress adjourned, of 748 combat aircraft.

Machine Tool Program Lags

The program to develop a broad mobilization base with a machine tool reserve is dragging. Defense Secretary Charles Wilson, cool toward the program, hasn't yet released any of the $250 million approved this year by Congress to launch it.

Air Force's list of requirements were submitted several months ago. But Wilson directed a review and this won't be completed by Air Materiel Command until the first of the year.

The Vance Committee recommended a $500-million outlay the first year to start the program and similar amounts in succeeding years to sustain a machine tool reserve.

Wilson reportedly vetoed the program and the $500 million included in the Truman military budget was reinstated by National Security Council.

Senate Military Appropriations Subcommittee, headed by Wilson's home-state senator, Homer Ferguson, halved the fund after Wilson testified he didn't know "whether I will need all that money" and that he didn't know "exactly what machinery we will spend it for."

ODM vs. USAF

Top officials of Office of Defense Mobilization don't share Air Force's enthusiasm to increase vastly titanium production. They feel USAF and aircraft manufacturers are making a vain try to telescope a 50-year project into a few years. They are particularly irritated with Brig. Gen. Kern Metzger's suggestion that USAF's titanium requirement may reach 100,000 tons a year in a few years. The cost of this would be $5 billion a year, or about half USAF's total current budget of $11 billion, according to ODM spokesmen.

Senators Object

Returning senators indicate that the coming session will be controversial on civil aviation matters:

- Sen. Edwin Johnson, top Democrat on the Senate Commerce Committee, will insist on a federally financed airport program and challenge the Administration's plan to abandon it. The program should be of national scope and not a hit-or-miss local proposition any more than roads development, he argues.
- Sen. Pat McCarran, top Democrat on the Senate's Commerce Appropriations Subcommittee, critical of Civil Aeronautics Board's decision authorizing nonskeds to transport mail, has demanded hearings. He referred to the action as "an unwarranted extension of . . . burgeoning power-grabbing philosophy" and wants legislation spelling out policy on irregular operations.

Budget Bureau Undercuts

Although Commerce's Undersecretary Robert Murray and other Republican chiefs assiduously are trimming budgets, they are not going far enough for Budget Bureau. With few exceptions, Budget Bureau has been making reductions in department and agency proposals, including a $4-million cut in Commerce's proposal for Civil Aeronautics Administration salaries and expenses for fiscal 1955, making it $92 million. The fiscal 1953 allocation: $143 million.

Civil Defense to USAF?

The recommendation to put Federal Civil Defense Administration in Defense Department doesn't have much steam behind it. It was recommended in the Temple University study, directed by the university's president, Robert Johnson, in which Milton Eisenhower, Pennsylvania State University president, and ODM director Arthur Flemming participated.

Air Force doesn't want responsibility for administering an essentially civilian program and is strongly opposed.

Guided Missile Tangle

Interservice differences have delayed completion of an evaluation of the guided missile program being made by a team under the chairmanship of Trevor Gardner, special assistant to the Secretary of the Air Force for Research and Development. Gardner hopes to get a unanimous report to the Office of Secretary of Defense by mid-January.

—Katherine Johnsen.

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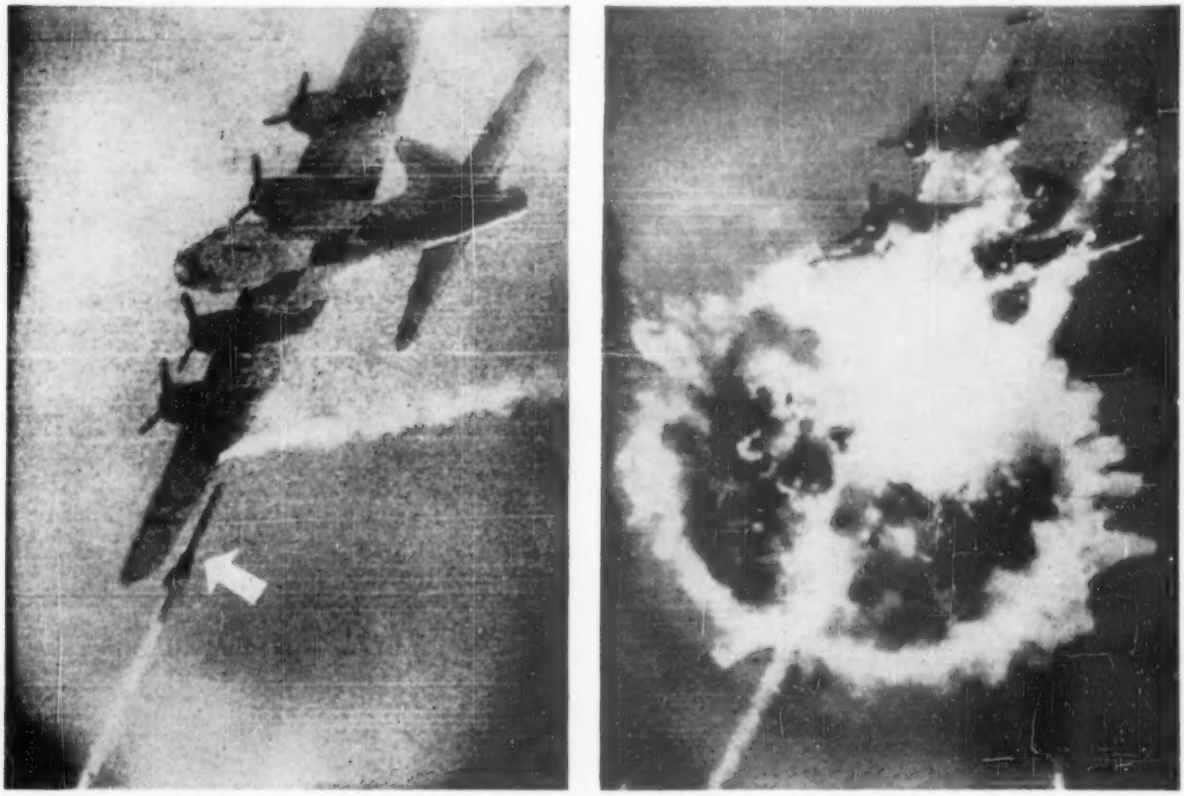
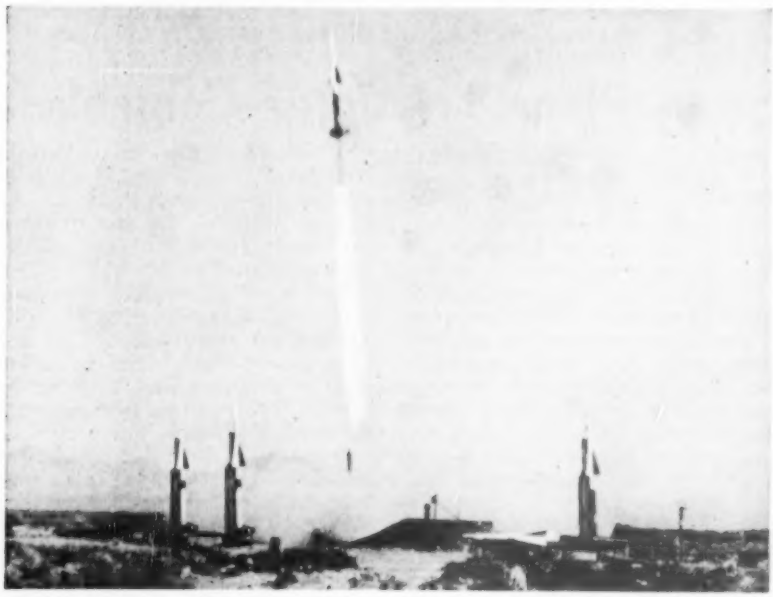


DEATH OF A BOMBER: Nike missile (arrow, left photo) streaks towards B-17; destroys it (photo, right).

U. S. Unveils Defensive Missile System



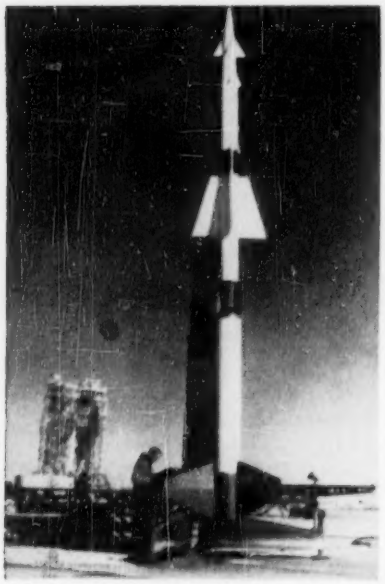
NIKE BATTERY at White Sands, N. M., with one missile being boosted skyward.

- **Army Nike rocket rides radar beam to target.**
- **But range is only 18 mi. from site of launching.**

First complete U. S. guided missile weapons system to emerge from official security restrictions was revealed with Army announcement of its supersonic Nike anti-aircraft rocket.

Indications that the Nike also is one of the first missile weapons systems to achieve a workable degree of technical reliability stems from the following Army statements:

- **Nike missiles** have successfully intercepted and destroyed B-17 bombers flying at altitudes up to 30,000 ft. under test conditions at White Sands Proving Ground, N. M.
- **Present configuration** of the Nike system has been committed to sizable production.
- **Nike systems** will be installed in the



NIKE ON LAUNCHER. Note booster.

near future as part of the inner air defense of key American cities. First Nike system is earmarked for Ft. George Meade, Md., for defense of Washington, D. C.

The Nike system was developed during eight years of cooperative effort by Army Ordnance Corps, Douglas Aircraft Co., Bell Telephone Laboratories and the Western Electric Co. Douglas is now manufacturing the missile and its components, while Western Electric is building the intercept and control system. Both firms are relying on an extensive network of subcontractors located in 21 states.

► **Delta Fins**—The Nike is a liquid-fueled, anti-aircraft rocket that operates at supersonic speeds and can be guided during its flight. It is about 20 ft. long, 12 in. in diameter. It has three sets of four delta fins spaced along the missile body for guidance. The forward fins are for steering and the aft fins for stability control.

Function of the third set of fins was not explained by the Army. The Nike body contains an explosive warhead, guidance equipment and the rocket propulsion system.

Nike is fired by a remotely controlled launching system and gets its initial impetus from a booster rocket that drops off when the missile attains its operational speeds.

► **Beam Rider**—The Nike guidance system consists of radar equipment that detects and tracks approaching targets, fires the missiles when targets come within range. Missile is guided by a beam-rider system to intercept the target where its warhead explodes. Warhead is safetied so that it can only explode in flight.

The Nike system is one of three anti-aircraft missile weapons systems currently under development by Defense Department. Navy has the Terrier system with Convair being the prime missile manufacturer, while USAF is sponsoring the Bomarc system developed by Boeing Airplane Co.

Army is counting heavily on the Nike system to replace its anti-aircraft guns for the air defense of fixed installations. However, the Nike system is contained in air-transportable vehicles and also can be used with troops in the field.

► **Inner-Area Defense**—Military observers point out that the Nike system is essentially an inner-target-area defense system because of its relatively limited range. It can reach out only about 18 mi. from its launching sites, which gives it an extremely short period of attack before high-altitude bombers make their drop of even conventional bombs. It is extremely doubtful if the Nike would be effective against bombers launching air-to-ground missiles.

Army has tested Nike successfully against B-17 bombers and also states officially that the missile "can outmaneuver bombers, fighters or transport planes."

Current configuration of the Nike missile offers several clues to control problems encountered in guidance of the missile during flight. An additional set of control fins has been added and the overall length of the missile has been reduced, considerably cutting its fineness ratio and aiding faster response to controls.

The original cluster of four booster rockets has been discarded in favor of a large, single booster. The new booster possibly is fueled by Thiokol while the sustainer rocket in the missile probably is an acid-aniline fuel type, developed by Aerojet-General Corp.

► **Started in 1945**—Nike development project originated in 1945 when the Army Ordnance Corps asked Bell Telephone Laboratories to undertake a study of the problems involved in developing a controlled anti-aircraft rocket.

Five months later, Bell Labs recommended a supersonic surface-to-air missile of relatively simple configuration. Douglas Aircraft Co. was brought into the picture as a full partner with Bell for the development phase. Douglas assumed responsibility for developing the missile and launching equipment. Bell concentrated on the guidance system.

Nearly five years were required to solve the technical problems posed by the Nike system. First test firings of the Nike without guidance were made at White Sands in 1946 to improve launcher and booster designs. First tests with guidance were made in 1951.

NEW LEASE ON LIFE for Tri-Motor (Air Corps Ford C-4A above) is under study.

Stout Plans Tri-Motor Comeback

Detroit—At least 100 of the famous Ford Tri-Motor all-metal transports will be built under new production plans announced here by designer William B. Stout, who says that a study is now underway on a market for the plane.

Stout says a group of California businessmen, whom he did not name, is setting up a company on the West Coast which will handle production. He indicated that the plane would be fundamentally "pretty close to the old design," although some changes may be necessary because modern engines are lighter and more powerful than the powerplants used in the original production versions built by Ford during the late 1920s and early 1930s.

► **For Bush Operators**—The new Tri-Motor transports are planned for bush operations since they will be able to take off from short strips carrying 4,000-lb. payloads. Stout says operators will be able to make practically any kind of repairs on the plane without requiring special tools. Price will be approximately $100,000.

Ford purchased the production rights to the original Tri-Motor July 21, 1925. The first prototype, which had the outboard engines mounted in the leading edges of the wing, was rolled out on Nov. 25, 1925, but was destroyed soon afterwards in a hangar fire.

A redesigned Tri-Motor, having the outboard engines mounted below each wing, completed its certification trials July 10, 1926. Two hundred were built.

Thirty still are flying, Stout notes.

Advanced versions of the Tri-Motor had a top speed of about 150 mph. and cruised at approximately 120.

YEAGER DISCUSSES X-1A with Larry Bell (right), builder of supersonic rocket plane.

X-1 Family

- **X-1 No. 1** made first supersonic flight of Mach 1.06 Oct. 14, 1947, now in the Smithsonian Institution, Washington, D. C.
- **X-1 No. 2** now being used by National Advisory Committee for Aeronautics at Edwards AFB.
- **X-1 No. 3** exploded and was totally destroyed on the ground during fuel operations at Edwards AFB.
- **X-1A** flew 1,650 mph. to reach Mach 2.5.
- **X-1B** completed by Bell and designed primarily for research on thermal problems encountered in highspeed flight.
- **X-1C** project canceled by USAF.
- **X-1D** destroyed in an explosion.

Mach 2 Problem: Violent Controls

X-1A's 1,650-mph. flight confirms need for substantial research before new 1,000-mph. aircraft are designed.

By Robert Hotz

First explorations of the supersonic speed range above Mach 2 by piloted aircraft confirm the need for a substantial research flight test program in this area before combat aircraft and winged missiles can be successfully designed for operations over 1,000 mph.

Maj. Charles Yeager, first supersonic pilot who set a new unofficial speed record of 1,650 mph. in reaching Mach 2.5 in the Bell X-1A (AVIATION WEEK Dec. 21, p. 7), reported violent control problems as he hit top speed.

Yeager's report came shortly after NACA test pilot Scott Crossfield indicated that problems of the transonic zone are accentuated as speed increases (AVIATION WEEK Nov. 30, p. 13). Crossfield was the first pilot to reach Mach 2.

► **Similar Problems**—Yeager declined to give details of his problems in the X-1A, but observers of the joint USAF-Navy-NACA highspeed flight research program indicated they were similar to those Yeager experienced in the original X-1 when he went into a highspeed stall about 63,000 ft. and fell more than 20,000 ft. before recovering.

The inner lining of the pressurized X-1A cockpit was shattered during violent maneuvers but there was no major structural damage to the aircraft which was built with double the safety factor of combat fighter aircraft.

► **Saw Shock Waves**—Yeager noted that the cockpit visibility was better in the X-1A than in the original X-1, but commented:

"I don't know whether that was any help because I saw a lot of things I'd rather not have seen. When I looked back I could see the wings buffeting and the shock waves on them. It was a rather rough flight. It certainly wasn't any gravy ride. I was quite busy with that airplane."

(At Edwards, an observer of the flight said the violent shocks which hit the plane as it approached its design speed of 1,700 mph. were severe enough to alarm the usually calm Yeager.

"His voice on the radio became very excited," he said. "And it's not like Yeager to get excited without great reason.")

Yeager also noted that the aircraft "got a little hot" from skin friction even though outside air temperature was —70F.

The X-1A record flight began with an air launch from 30,000 ft. from a B-29 piloted by Maj. Harold Russell, chief of the bomber flight test section of the USAF Flight Test Center at Edwards AFB. Yeager fired three of his four Reaction Motors, Inc., rocket tubes for a climb to 45,000 ft. where he cut in the fourth tube.

He flew at full power in an arc to 70,000 ft. where he leveled off, reach-

TUCKED UNDER B-29, Bell X-1A is carried to 30,000 ft. for air launching.

BELL X-1A is similar to earlier X-1 but has stepped-up canopy for better visibility.

ing maximum speed just about 70,000 ft. before his rocket fuel was exhausted.

▶**Lighter Weight**—Yeager said he experienced less trouble in returning through the transonic zone to subsonic speed than on his initial penetration because of the lighter weight of his aircraft with the fuel burned off and the higher altitude at which he made his return. It was Yeager's fourth X-1A flight.

Lawrence Bell, chairman of the board of Bell Aircraft Corp., builders of the X-1 series, said the X-1A flight test program was gathering valuable data for guided missile development and noted that Maj. Yeager had flown faster in the X-1A than many guided missiles.

The principal difference between the X-1 in which Yeager became the first man to fly faster than the speed of sound and the X-1A is in the latter's double fuel capacity and the use of turbo-driven fuel pumps.

The fuel pumps' turbos are driven by steam generated from passing hydrogen peroxide over catalytic crystals that expand its volume at a ratio of 1,000 to 1. The rocket fuel is an alcohol-water combination with liquid oxygen as the oxidizing agent.

▶**Gross 18,000 Lb.**—Yeager said it was the practice with the X-1 series to use full power until the usable fuel was exhausted and then jettison any residue fuel to avoid any further stability problems on the gliding flight back to base.

The X-1A weighs 18,000 lb. fully loaded when it drops from the B-29 bomb-bay and has a stalling speed of 245 mph. at that weight. When fuel is exhausted it weighs 7,000 lb. and has a stalling speed of 178 mph. clean and 150 mph. with flaps and gear down. Yeager said he generally landed at about 155 mph.

At empty weight the X-1A has a glide ratio of about 15 to 1.

Both Yeager and Bell emphasized that the X-1A was essentially a conventionally designed aircraft using knowledge available from the subsonic era of flight.

It has a subsonic airfoil and uses elevator and horizontal stabilizer instead of the all-flying "slab" tail that subsequent research has proved desirable for supersonic flight controls.

Bell said he expected the X-2 to fly under power some time next year, that it had a far greater speed potential than the X-1 series.

50 Years of Powered Flight

Eisenhower Backs Air Buildup

President tells Wright 50th anniversary celebration that airpower is 'absolutely essential' to U. S. defense.

Powered flight's year-long golden anniversary celebration of Wilbur and Orville Wright's first successful flight at Kitty Hawk, N. C., Dec. 17, 1903, was climaxed by these declarations:

• **President Eisenhower** called airpower "absolutely essential" to U. S. defenses.

• **Lt. Gen. James H. Doolittle** (Ret.), chairman of the national committee for the 50th anniversary, said aviation's three future jobs would be increasing public understanding of the industry, improving airports and maintaining a realistic, long-term program for the development, procurement and operation of military aircraft.

• **Glenn L. Martin** forecast 25,000-mph. interstellar space ships and giant 200-passenger jet airliners.

Billy Parker, holder of pilot's certificate No. 44, topped the four-day Kitty Hawk celebration by re-enacting the first flight in his hand-made 1912 pusher plane at the exact time and place of the Wrights' history-making venture on Kill Devil Hill.

▶**Real Safety**—Speaking at the annual Aero Club Wright Dinner in Washington, D. C., the President told 1,700 celebrants that despite the need for airpower in this atomic age, "no armed forces, of whatever nature, provide real safety over the long run for any nation."

"The power of the surprise attack," he said, "grows so great something must be done about it."

Following his off-the-cuff message, the President presented:

• **The Collier Trophy** to Leonard S. Hobbs, vice president-engineering of United Aircraft Corp., for designing the Pratt & Whitney J57 turbojet (AVIATION WEEK Dec. 21, p. 15).

• **The Wright Brothers Trophy** to Rep. Carl Hinshaw for "public service of enduring value to aviation."

• **The Brewer Trophy** to Dr. Leslie Bryan of the University of Illinois for advancement of aviation education.

▶**Off-Key Red Hate**—Only off-key note of the entire jubilee celebration this year, said Doolittle, was the comment of the Red Star, Soviet army newspaper, that the American celebration was "propaganda to prove the priority of the Wright brothers in the invention of the airplane."

The Soviet claims A. F. Mozhaisky, Russian inventor, built an airplane more than 20 years before the Wrights.

"Within the foreseeable future," said the general, "there will be the exciting challenge of space exploration."

▶**Calls for Strength**—"Increasing ease of travel by air will create a better understanding among men," Doolittle said. "People will discover that they are much alike, after all.

"Our first concern as we enter the second half-century of powered flight must be to remain strong enough to preserve freedom, for only if freedom endures can aviation and all the other marvels of the age of flight continue to fulfill the promise of a magnificent past."

▶**Aviation's Future**—Glenn L. Martin, speaking before the Institute of the Aeronautical Sciences, predicted these developments during the next 50 years of flight in America:

• **Interstellar space ships** with speeds of 25,000 mph.

• **Giant 200-passenger jet airliners** crossing the continents and the oceans in literally zero time westerly.

• **Atomic-powered aircraft**, first as bombers capable of multiple nonstop circumnavigation of the globe; secondly, as passenger transports.

• **Helicopters** carrying all airline traffic over distances of 150 mi. or less.

• **Flying boats** with speeds matching that of equivalent landplanes but with greater capacity for cargo, passengers or weapons.

• **Fully automatic airline flight** operations through electronic guidance and control equipment.

• **Reductions in cost** of air travel, well below that of any other form of transportation.

Parker's re-enactment of the first flight climaxed a four-day celebration on Kitty Hawk's sand dunes, during which the reconstructed site of the Wrights' flight on Kill Devil Hill was dedicated.

Hangar and living quarters used by the Wrights in 1903 were rebuilt and furnished and the site taken over by the National Park Service.

▶**DC-7 Record**—Several air maneuvers over the Wright Memorial were held.

A National Airlines DC-7 flew over the site shortly after the new transport had set a non-official transcontinental record of 5 hr., 54 min. between the Douglas Aircraft Co. plant at Santa Monica, Calif., and Washington National Airport.

Representing the military were a flight of Air Force North American F-86F Sabres, various Navy, Marine and Army aircraft and the British Electric Canberra bomber that won this year's England-New Zealand air race. The British bomber flew from Aldergrove, Ireland, to Kitty Hawk in 8 hr. 15 min. to help demonstrate the strides aviation has taken.

F4D Tries for New Airplane Altitude Mark

Edwards AFB, Calif.—Navy last week was attempting to set a new world's airplane altitude record with the Douglas F4D Skyray. Mark is 63,668 ft., set by a British Canberra last May.

Two attempts to return the record to the U.S. failed because of difficulties with the Skyray's Westinghouse J40 powerplant.

Piloting the F4D on its record-breaking attempts was Lt. Cmdr. James Verdin, who set a 3-km. world speed record in the Navy fighter (AVIATION WEEK Oct. 12, p. 16).

Unofficial world's altitude record of 83,235 ft. was established Aug. 21, 1953, in the Douglas Skyrocket by Marine Lt. Col. Marion Carl. A free balloon mark of 72,394 ft. was set in 1935.

The Skyray was shooting for the heavier-than-air mark under official regulations for an altitude trial. The F4D must top the Canberra record by at least 1% to qualify its record as official.

Continental-Braniff Merger Proposed

Civil Aeronautics Board has proposed a merger of Braniff Airways and Continental Air Lines as an alternative to the voluntary Continental-Pioneer agreement submitted this month (AVIATION WEEK Dec. 21, p. 69).

Washington observers had known of CAB's long-time desire to bring CAL off subsidy but believed the Board also might approve a voluntary Continental-PAL merger as better than nothing in the way of reducing subsidies.

▶ **To Check Merits**—The Board in effect says that while not prejudging its decision on the pending CAL-Pioneer case, it would simultaneously investigate the merits of a Braniff-Continental merger.

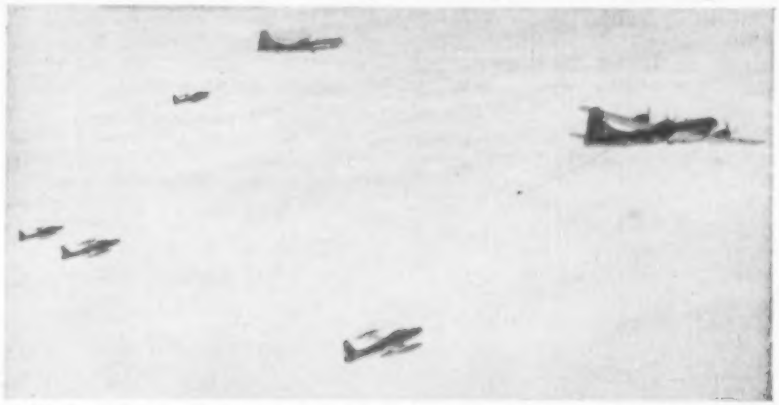
CAB says it makes this proposal "solely for the purpose of insuring that should the record in the proceeding dictate disapproval of the voluntary arrangement between Continental and Pioneer, the Board will be in a position to determine whether integration of the routes of Continental and Braniff would be consistent with the public interest."

This will delay the Continental-Pioneer case, and even if CAB decides a Braniff-CAL merger would be in the public interest, the Board would have to await a voluntary agreement.

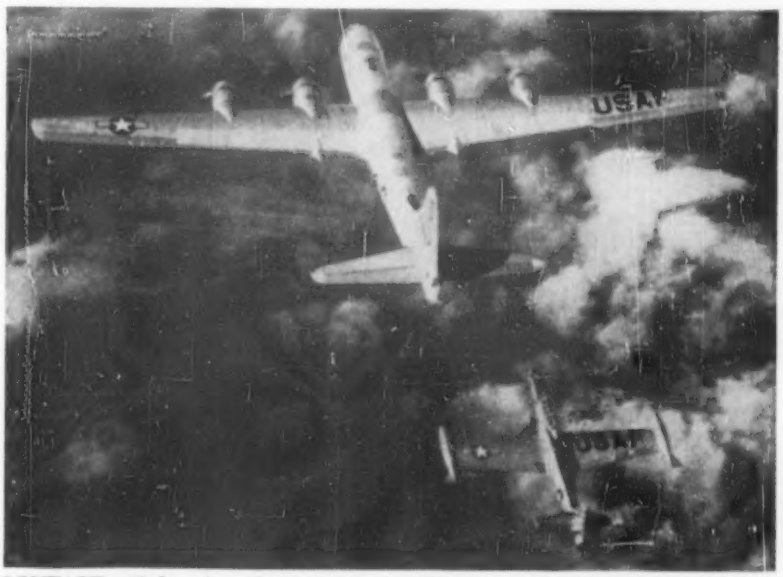
Wording of the CAB consolidation order does not propose a three-way Braniff-Continental-Pioneer merger.

▶ **Trunk-Feeder Merger**—CAB members may vote against the Continental-

Thunderjets Fly Tokyo-Bangkok Nonstop

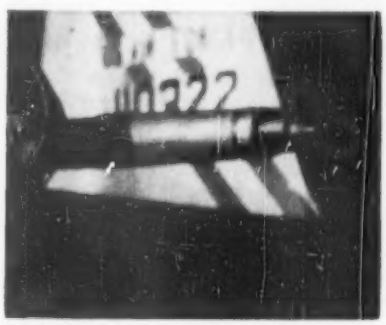


FOUR F-84GS MOVE IN to take on fuel from a pair of Boeing KB-29M Superfort tankers high over the South China Sea during course of 2,500-mi. nonstop training flight from Tokyo to Thailand. Jets are using Flight Refueling probe-and-drogue system.



CONTACT with hose is made by probe protruding from nose of Thunderjet's port tiptank. These F-84Gs are using tiptanks modified for this method of air refueling. They also have refueling inlet in wing near cockpit to take Boeing Flying Boom system.

NOSE of modified tank is fitted with protective guard of crossed metal strips. Tank is standard 230-gal. receptacle.



PROBE, which contacts tanker's hose, juts from inboard side of F-84G's tiptank. These are first photos of installation.

Pioneer merger on grounds that it would reverse the previous Board policy of transferring small cities from trunk to local service routes.

For instance, CAB took California towns from United Air Lines and gave them to Southwest. If the Board were to propose a merger of Southwest and Western Air Lines, it would bring about a transfer of United towns to competitor WAL.

However, the burden of proof is on CAB to show the voluntary Continental-Pioneer merger would be contrary to the public interest. Otherwise it must be approved.

CAB Will Submit New Balboa Proposal

White House within a few days will get Civil Aeronautics Board's recommendation as to which competitive combinations of airlines would best serve the New York-South America market.

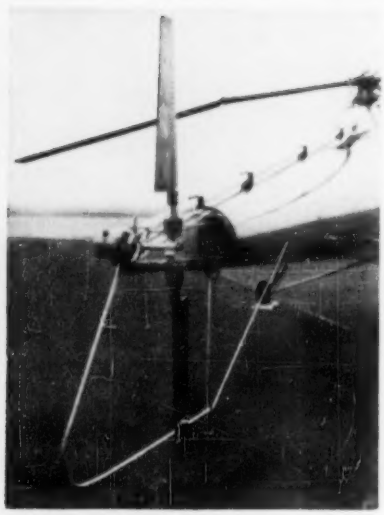
This is the "Balboa service case," presenting through-service interchange proposals.

Two possible combinations:

- **Eastern-Pan American and National-Braniff.**
- **EAL-Braniff and National-PAA.**

The problem of which way to settle this question twice has stumped CAB and two U. S. presidents.

In oral argument before CAB, Pan American and Eastern noted that their proposal was in the form of a voluntary agreement already signed and ready. But Braniff and National said they are smaller and that CAB and the White House should not overpower their position by permitting a stronger EAL-PAA union.



First Photos of New Brantly Copter

Here is new Brantly B-2 two-place all-metal helicopter demonstrated to the public for the first time at recent opening of new airlines terminal building, Philadelphia, (Pa.) International Airport, Dec. 12. Top photo shows craft in flight. It is powered by a 135-hp. Lycoming, but later a 150-hp. engine is to be installed. Closeup view (left) shows details of main rotor blade mounting. Each blade has two hinges, one at the rotor head and one at the end of the 42-in.-long rotor pylons. Blade chord is eight inches. Each blade is built up of an extruded aluminum spar, aluminum ribs and aluminum covering. Note large bubble in roof of cabin. There is another on right side. Baggage compartment door is shown open behind landing gear rear strut. Details of B-2's tail rotor are revealed in right picture. It is driven by shaft mounted atop fuselage and is of all-metal construction. Note protective bumper. Overall length of the B-2 is 17 ft. 11 in., height is 6 ft. 10 in. Main rotor diameter is 23 ft. and tail rotor diameter is 3 ft. 10 in. Gross weight (150-hp. version) is given as 1,250 lb. and empty weight 741 lb. Brantly Helicopter Corp. is located in Philadelphia.

Turboprop R3Y-1 Begins First Tests

San Diego—Consolidated Vultee Aircraft's first production R3Y-1 Tradewind cargo seaplane is undergoing extensive water taxiing trials and tentatively is scheduled to begin flight tests early next month.

Convair launched the big turbo-powered Navy transport Dec. 17, claiming the Tradewind as the first new aircraft introduced during the second half century of powered flight.

▶**Fastest Flying Boat**—The flying boat is the first of a fleet of R3Ys ordered by Navy (AVIATION WEEK Mar. 30, p. 18) and is scheduled to begin trans-Pacific flight out of Alameda, Calif., next year.

Powered by four Allison T40 turboprops that develop more than 5,500 eshp. each, the flying boat's top speed is estimated at faster than 350 mph. and is described by Convair as the world's fastest seaplane transport.

R3Ys will be equipped with air conditioning and high-altitude pressurization systems.

They also will be fitted with rearward-facing passenger seats to transport troops and wounded personnel.

▶**Convair's Largest**—Built into the Tradewind's hull is multi-cell compartmentation below the cabin floor level, giving water-tight integrity and leaving the cabin free of bulkheads and other obstructions.

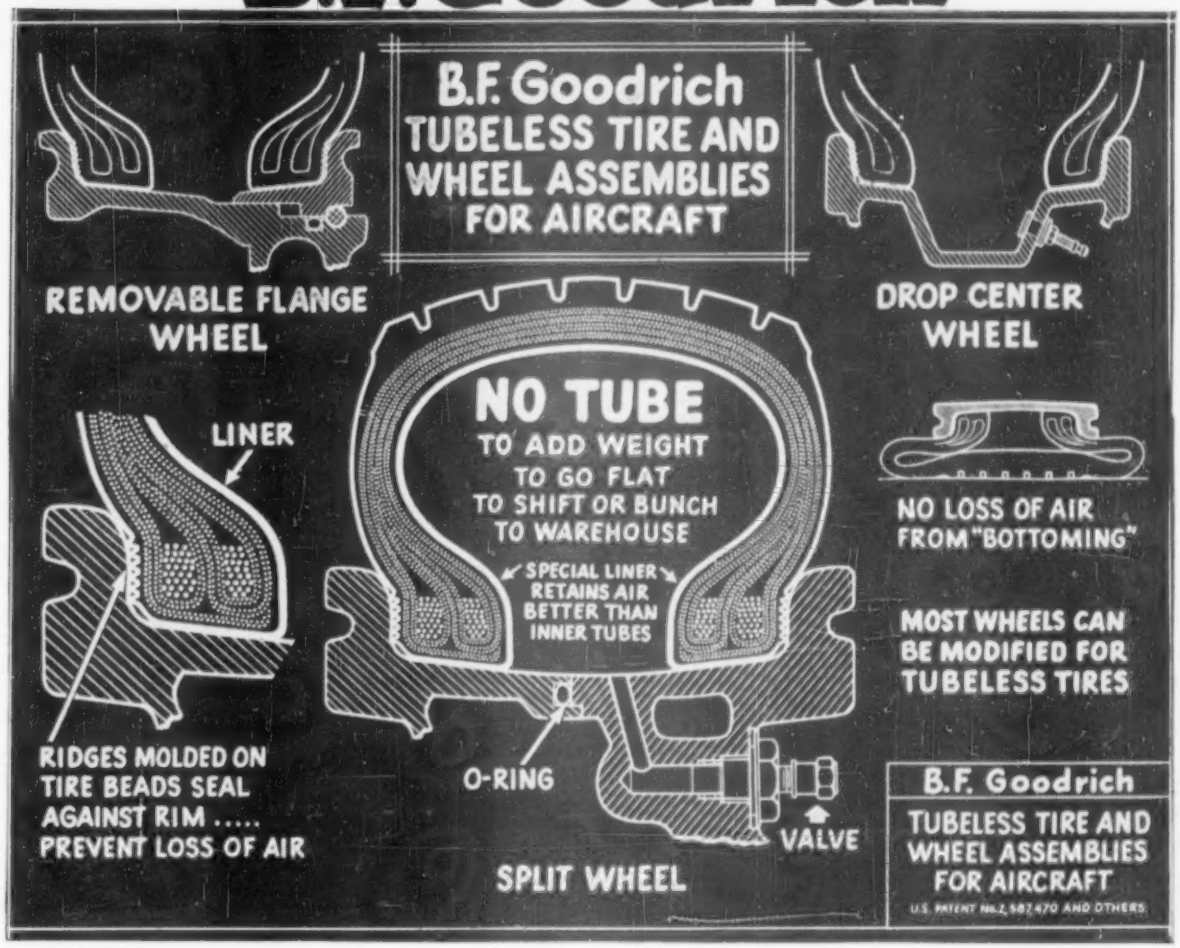
Largest water-based plane produced by Convair, the R3Y has a wingspan of approximately 145 ft., measures 142 ft. 6 in. from stem to stern, and its height over the tail when on a beaching cradle totals 51 ft. 6 in.

Its length-over-beam ratio is 10, about double that of previous designs built by the company.

Rohr Top Salaries

Rohr Aircraft Corp., Chula Vista, Calif., paid its president and general manager, Fred H. Rohr, $75,000 for the year ending July 31. J. E. Rheim, executive vice president and assistant secretary, received $50,000. All officers and directors received $170,720. The firm had net income of $1,533,285.

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



New Tubeless Tire for airplanes cuts weight, gives safer landings

TAKE OUT the inner tube and you do more than save weight, simplify assembly. You get a high-pressure airplane tire that's safer, too. B. F. Goodrich engineers were the first to develop and produce one. The blueprint above helps show how they did it.

Instead of an inner tube, the B. F. Goodrich airplane Tubeless Tire has a patented inner liner that's part of the tire itself. There is *no tube* to add weight. No tube to go flat—to bunch up or shift during landings and take-offs. Instead of tire and tube, there's only one unit to mount. Only one unit to warehouse, too.

The patented inner liner retains air much longer than conventional tubes. Ridges molded on the outside of the tire bead prevent air loss around the rim. On two-piece wheels, a rubber O-ring seal keeps air from escaping through sections. A special Navy "bottoming" test shows the new BFG airplane Tubeless Tire loses no air even when compressed flat to the rim.

The B. F. Goodrich airplane Tubeless Tire will soon be in general use on Grumman Cougar jets in Navy service. It will soon be seeing service on other military planes as well as commercial aircraft. It's another first in aviation tires from B. F. Goodrich, leader in rubber research and engineering.

Other B. F. Goodrich products for aviation include wheels and brakes, De-Icers, heated rubber, Pressure Sealing Zippers, inflatable seals, fuel cells, Rivnuts, accessories. *The B. F. Goodrich Company, Aeronautical Sales, Akron, Ohio.*

B.F. Goodrich
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Weather has its brighter side

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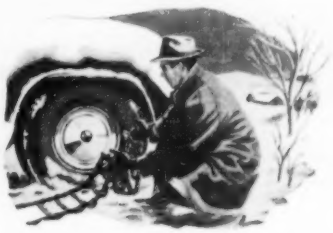
Your whole picture of winter travel will change for the better once you've flown TWA. For all thoughts of icy roads and snowbound delays melt away when you travel at TWA's "fair-weather" level. Up here sunshine knows no season; the stars light your way at night. And while your TWA Skyliner makes time, you spend it in leisurely fashion . . . enjoying the kind of service that's made TWA first choice of more than two million passengers each year.



Where in the world do **you** want to go? For information and reservations, call TWA or see your travel agent.

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TRANS WORLD AIRLINES

Rickenbacker Studies Piasecki Helicopters

Need for a helicopter seating 40-50 passengers and cruising at 200 mph. or better was expressed by Eastern Air Lines board chairman Eddie Rickenbacker, following a conference with Piasecki Helicopter Corp. officials in Philadelphia, Pa.

The airline executive, accompanied by EAL chief engineer Charles Froesch and other officials, inspected Piasecki facilities, various copters in production and then sat in on a round-table discussion with the builder's executives and engineers.

Rickenbacker commented after the conference that "because of the rapid development of the helicopter, it should be possible to produce an acceptable helicopter within the next few years." He said that by 1960, copter services should be flying 5-6 million passengers annually on intercity routes.

There was no intimation that Eastern had made any commitment to buy helicopters during the visit. An EAL spokesman said he knew of no plans by Rickenbacker to visit other copter manufacturers in the near future.

Atlas Defends NEA Convair Transaction

Atlas Corp. denies a Civil Aeronautics Board enforcement office charge that the company diverted capital gains from subsidized Northeast Airlines, which it controls, to Airfleets, Inc., an Atlas affiliate.

Atlas' answer to the CAB complaint notes that the Northeast sale of five Convair-Liners at cost relieved NEA of the heavy capital burden of unnecessary equipment. Airfleets offered to sell the planes to Northeast before selling three of them to Alitalia, an Italian airline, Atlas president Floyd Odlum says. He adds that Airfleets still has more than $1 million tied up in the remaining planes.

New RCAF Building Is A-Bomb-Resistant

A new atom-bomb-resistant, windowless concrete warehouse a quarter of a mile long has been completed for the Royal Canadian Air Force at Downsview, outside Toronto, as part of the RCAF No. 1 Air Material Base. It is 528 feet wide and 22 feet high, and at one end has a three-story office and annex to handle administration.

Building facilities include loading ramps adjustable to any truck or boxcar height and an endless chain conveyor

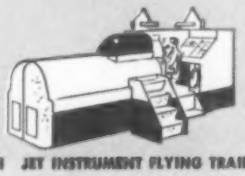
25 years of Synthetic Flight Training for AMERICA'S ARMED FORCES

As the air world expands so do the requirements for the complex electronic equipment that trains more pilots for the air age.

As 1953 draws to a close, LINK looks *back* 25 years with pride to its contributions...and *ahead* on the new and exciting developments yet to come.

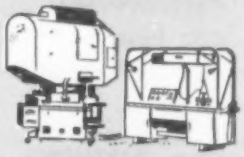
This year, LINK was privileged to build and deliver a varied group of trainers and simulators to our Armed Forces and to our friends in aviation the world over. In addition to the delivery of these marvels of the air age, LINK in many cases furnishes the personnel to install, operate and maintain LINK equipment.

From the beginning of synthetic flight training, 25 years ago—LINK'S record has been one of constant pioneering and growth...determined to make America's Armed Forces *better trained—safer—stronger* for the air age yet to come.

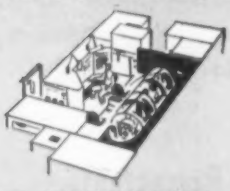


C-11 JET INSTRUMENT FLYING TRAINER

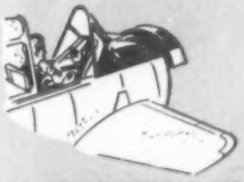
E-26 FLEXIBLE GUNNERY TRAINER



C-8 INSTRUMENT FLIGHT TRAINER



E-4TS JET FLIGHT SIMULATOR



P-1 CONTACT FLIGHT TRAINER

P2H-2 JET OPERATIONAL FLIGHT TRAINER

the connecting link between ground and sky

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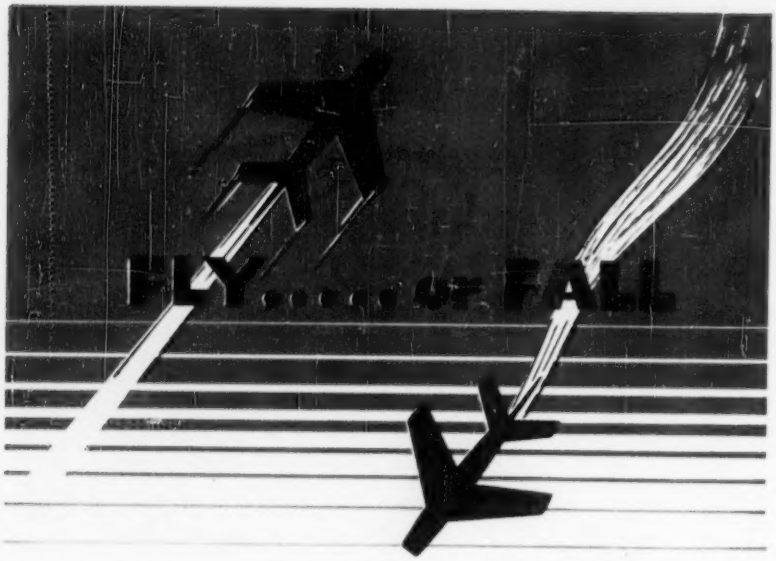
LINK invites employment applications from engineers and draftsmen



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AIR INTAKE SCREENS
Could make the difference

The safe interception of exasperatingly small bits of debris entering the engine intake could mean the difference between a safe return and no return.

Retractable Air-Intake Screens are a means of protection that allows the mission to be accomplished without the performance loss and icing hazard of fixed screens.

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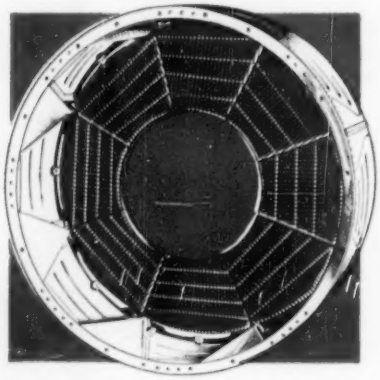
AIR INTAKE SCREEN

Specifically designed and manufactured for axial flow compressor gas turbines . . . Hydraulic actuation system contained within the screen housing . . . Strict adherence to AN standards and aircraft quality throughout.



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concealed below floor level moving at about 3 mph. around the building.

RCAF will employ about 3,000 uniformed personnel and civilians at this base when it is fully completed.

New TWA Service Boosts Connie Speed

Trans World Airlines has been able to maintain consistent 8-hr. schedules on new nonstop east-west transcontinental flights by using 1,500-1,600-hp. cruise setting on its 1049E Super Constellations.

Although considerably more horsepower is being pulled from the Wright R3350 engines to keep on schedule, only one failure has occurred. That apparently was due to a broken valve spring and was not attributed to the increased power settings.

► **Gradual Increase**—Before beginning nonstop transcontinental service, TWA used 1,600 hp. for climb and 1,325 hp. for cruise on its Super Connies. When the new service started, climb power remained the same but cruise power was upped to 1,425 hp. to meet scheduled time.

This proved insufficient. So climb powers gradually were increased to the current setting of 1,900 hp. Cruise powers rose to between 1,500 and 1,600 hp.

► **Fastest Time**—With these settings, put into effect in November, TWA has been able to maintain its 8-hr. schedule consistently. For the first part of November, its fastest transcontinental time was 7:22 hr., and its slowest 7:45 hr.

Fuel flow increased from 660 lb./hr./engine at 1,325 hp. to 775 lb./hr./engine at 1,500 hp. This means an average flight of 8 hr. consumes 3,680 lb. (613 gal.) more fuel.

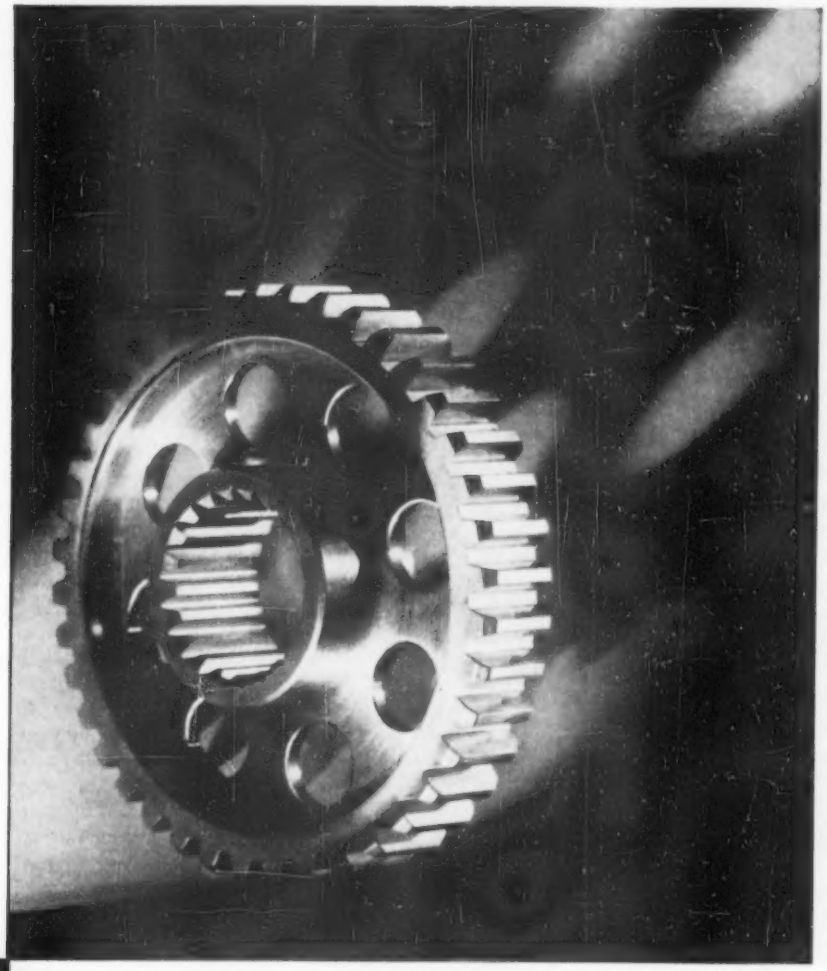
Flights usually are flown at an elevation of 19,000 ft.

Delta Pays President $33,000 Salary

Delta Air Lines, Inc., Atlanta, Ga., paid its president and general manager, C. E. Woolman, a $33,000 salary for the fiscal year ended June 30, 1953, the airline reports to the Securities & Exchange Commission. Delta merged with Chicago & Southern Air Lines, Inc., May 1.

In addition, Woolman received $37.50 in bonus and profit shares plus $5,931 in pension retirement and similar payments under the airline's group annuity contract and retirement income plan.

Officers received a total $113,212 in salaries, $262 in bonuses and profit shares plus $14,481 in pension retirement and similar payments.



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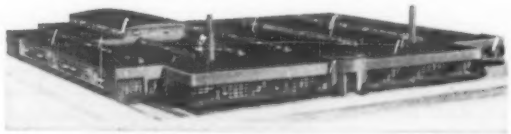
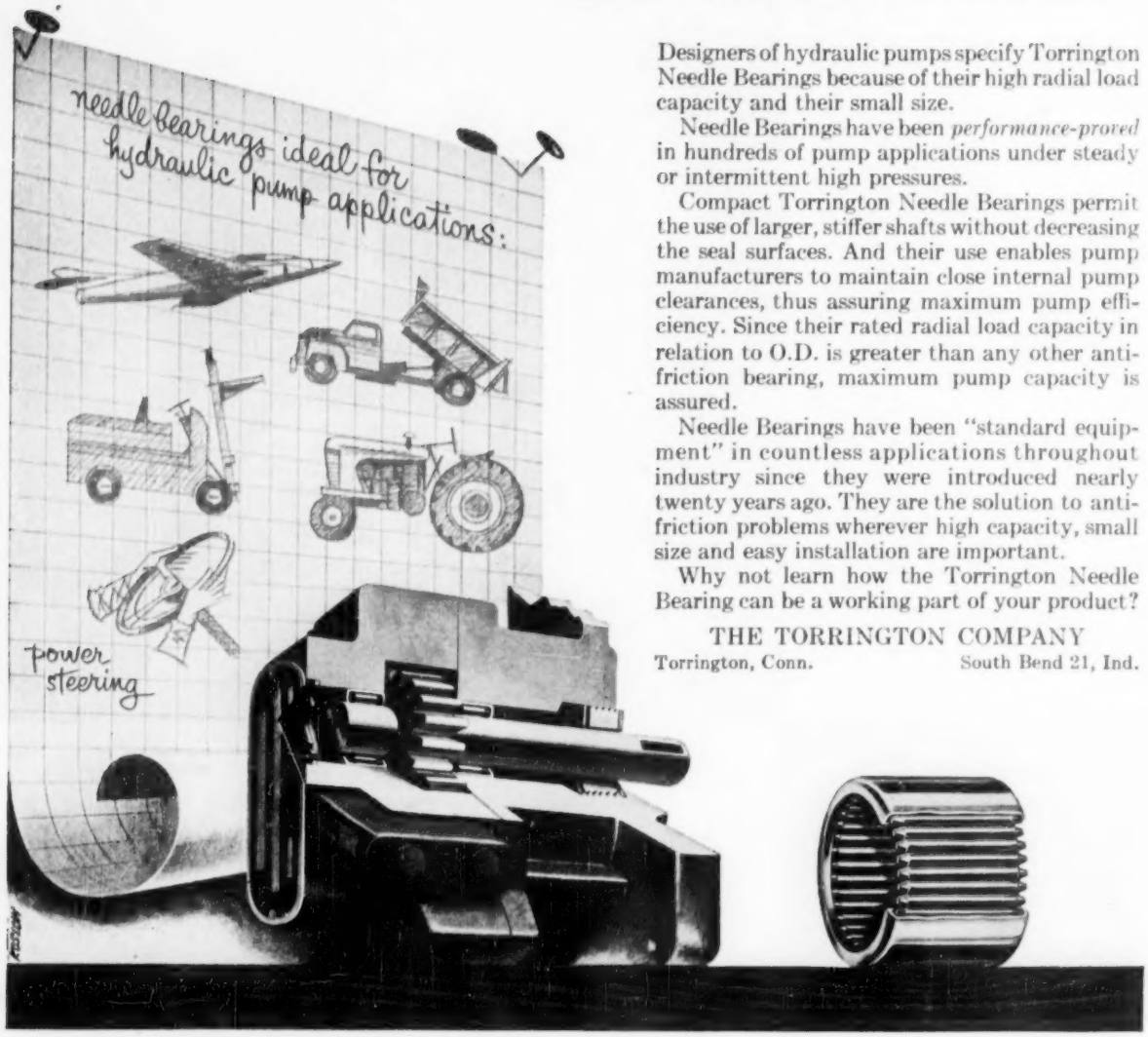


MAKE AMGEARS YOUR GEAR DEPARTMENT

Need a high capacity bearing with small size?

here's how hydraulic pump manufacturers get it with NEEDLE BEARINGS



Designers of hydraulic pumps specify Torrington Needle Bearings because of their high radial load capacity and their small size.

Needle Bearings have been *performance-proved* in hundreds of pump applications under steady or intermittent high pressures.

Compact Torrington Needle Bearings permit the use of larger, stiffer shafts without decreasing the seal surfaces. And their use enables pump manufacturers to maintain close internal pump clearances, thus assuring maximum pump efficiency. Since their rated radial load capacity in relation to O.D. is greater than any other anti-friction bearing, maximum pump capacity is assured.

Needle Bearings have been "standard equipment" in countless applications throughout industry since they were introduced nearly twenty years ago. They are the solution to anti-friction problems wherever high capacity, small size and easy installation are important.

Why not learn how the Torrington Needle Bearing can be a working part of your product?

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TORRINGTON *NEEDLE* **BEARINGS**

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Trade-marks of some of the leading hydraulic pump and motor manufacturers whose products enjoy the benefits of Needle Bearings.

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Representative Aircraft Companies

Company	Market price	Est. sales 1953 ($ mill.)	% Gain over 1952	Sales per $ of market price[1]	Sales as % of peak war year	Backlog ($ mill.)	Backlog in years[2]	Price as % of working capital per share	Working capital as % of sales	% Yield (1954 est. divds.)
Bell	22	160	24	8.20	69	464	2.9	237	6.6	6.8- 9.1
Boeing	48	825	12	10.60	136	1,650	2.0	154	6.1	6.3-10.4
Curt. Wr.	7.4	400	23	7.70	23	1,050	2.6	71	20.8	8.1-17.5
Douglas	73	825	58	9.40	78	2,100	2.5	178	6.5	8.2-11.0
Fairchild	8.5	160	13	8.10	156	335	2.1	168	9.7	9.4-14.1
Grumman	23	250	13	5.40	77	610[3]	2.4	183	10.0	8.7-10.9
Lockheed	26	765	75	11.70	115	1,690	2.2	181	4.7	5.8-11.5
Martin	15	170	18	5.30	28	650	3.8	2,885	11.7	Nil
NAA	18	650	106	10.50	91	1,130	1.7	153	6.2	8.3-11.1
Republic	24	450	9	17.00	122	1,000	2.2	263	3.0	8.3-12.5
United	42	800	20	6.00	108	1,600	2.0	314	8.5	7.1- 8.3

NOTES. [1] $\left(\frac{\text{Sales}}{\text{No. of shares}}\right) \times$ (Market price).

[2] The number of years of production at the 1953 rate that are assumed by the present backlog of unfilled orders.
[3] Includes letters of intent of $230 million.

SOURCE: Value Line Investment Survey.

Survey Tabs Aircraft Future Good

A bright outlook for the aircraft industry is forecast in the current issue of the Value Line Investment Survey.

Sales for most of the companies in the industry have built up sharply and are now stabilizing at close to peak levels, the service reports. Furthermore earnings are indicated as still rising and several dividend increases have already been made, with more forthcoming, despite the squeeze that higher sales have placed on working capital.

▶ **Strong Case**—Value Line believes there is a strong case for aircraft securities because:

- "A strong Air Force is our first line of defense—and our first line of offense.
- "Aircraft procurement does not depend on the level of general business activity.
- "Backlogs are huge.
- "The present Administration is planning on a prolonged cold war.
- "The present Administration is concentrating orders on the primary developer-producers."

The survey concludes: "Never before has the aircraft industry had greater assurance of stable and continuous high-level operation for so long a period into the future."

▶ **Big Eleven**—Value Line analyzes 11 of the aircraft companies as to their respective positions and outlook. The accompanying tables reveal various highlights in certain major respects, facilitating comparisons.

On the basis of estimated sales for 1953 together with the percentage gain expected over 1952, North American

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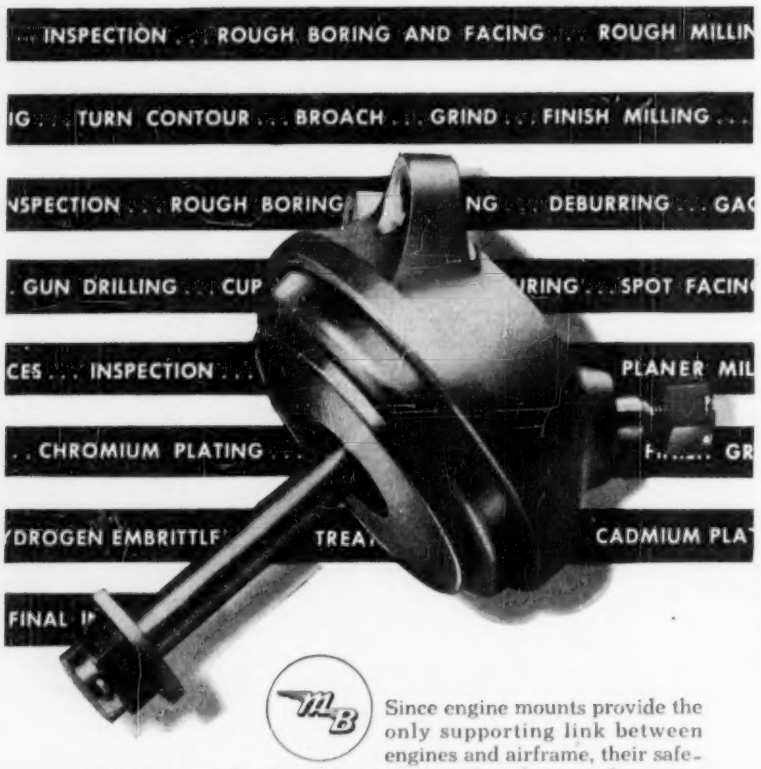
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NSPECTION . . . ROUGH BORING
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. GUN DRILLING . . . CUP
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Since engine mounts provide the only supporting link between engines and airframe, their safety factor must be beyond question. Also their performance.

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Widespread, consistent usage of these MB engine mounts by the aviation industry for the last 15 years *proves* that they're not only engineered right but also produced right.

Remember – Vibration is MB's specialty. You're invited to draw on the results of this specialization – namely, highly qualified products and technical help.

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. . . TO EXCITE IT . . . TO MEASURE IT

Aviation shows up with the greatest anticipated gain, some 106%. Republic is the lowest with a projected gain of only 9%. (However, during 1952 Republic reached a high level of sales.)

Another interesting measure is present in the sales realized per dollar of the market price of the individual aircraft equities. On this score, Republic shows up best with $17.00, and Martin the least bountiful with only $5.30.

▶ **Deliveries**—How do current deliveries compare with those of the peak war year? A comparison shows that Fairchild is way out in front, with expected sales of 156% of its best war year. Curtiss-Wright has the longest distance to go in order to equal its past best sales —this year's results are projected at only 23% of its high-water mark.

Assuming that deliveries will be maintained at current rates, backlogs indicate sustained sales for an average of two and a half years for the companies involved. But this is an academic measure, as inevitable schedule revisions introduce important modifications in sales projections.

▶ **Working Capital**—Wide ranges prevail in the market prices placed on working capital evaluations. For example, Martin's equity sells at a price almost 29 times its last reported working capital balance. On the other hand, Curtiss-Wright's common stock sells below its working capital. Here, too, an important qualification is present, since the nature of working capital accounts and their ultimate disposition must be known before this measure can be accorded any substance.

Working capital as a percentage of sales indicates the degree to which operations are financed. This is an important measure particularly in the light of the squeeze on progress payments now indicated for the aircraft builders. Curtiss-Wright shows up as providing more working capital in relation to its sales than any other company, some 20.8%. Republic contributes the least, 3%.

Liberal income yields for 1954 are also indicated. In most cases, Value Line projects dividends at slightly higher levels for 1954 compared with 1953. It can be seen that on the basis of the Value Line estimates, the average yield may range from almost 8% to more than 11%. Fairchild, Grumman, Republic and North American, in the order named, are expected to provide a greater measure of income return, according to the service's estimates.

Each of the 11 aircraft companies is reviewed in greater detail by Value Line. An optimistic outlook predominates.

(The opinions reviewed are those of Value Line advisory service and not necessarily those of the undersigned or AVIATION WEEK.)

—Selig Altschul

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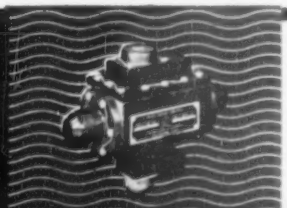
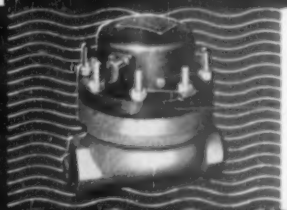
Extensive research and development facilities coupled with precision production methods contribute immeasurably to Revere's reputation for highest quality control instruments. Contact Revere's field engineering department today. Let qualified engineers assist you with your liquid or electro-mechanical control problems . . .

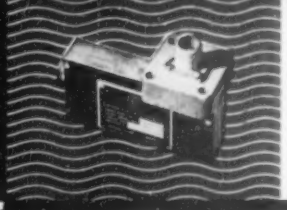
FUEL FLOW SWITCH
Specially designed by Revere for use in the auxiliary fuel line of the McDonnell F2H-3 twin-jet, carrier-based fighter. This instrument transmits a warning signal whenever fuel flow falls below a pre-determined value. *Send for Bulletin No. 1400*



FUEL FLOW TRANSMITTER
The Revere Fuel Flow Totalizer is an integral part of the fuel system. It records the rate of fuel flow in the T-33's jet engines. The flow totalizer can be used on piston engines, diesels or test stand operations. *Send for Bulletin No. 1300*



LIQUID LEVEL SWITCH
Republic's F-84G Thunderjet, first USAF fighter-bomber to refuel in mid air, has Revere's Liquid Level Switches installed in their fuel tanks. This hermetically-sealed, magnetically actuated switch presents a new standard of safety. *Send for Bulletin No. 1100*



FLOAT SWITCH
Boeing's B-47 Stratojets have Revere Float switches installed in all fuel tanks to maintain high-level fuel control. These switches can be furnished with single or dual float systems with levels set at the factory. *Send for Bulletin No. 1200*

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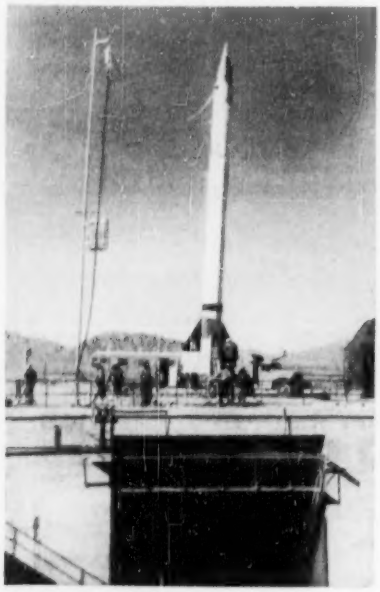
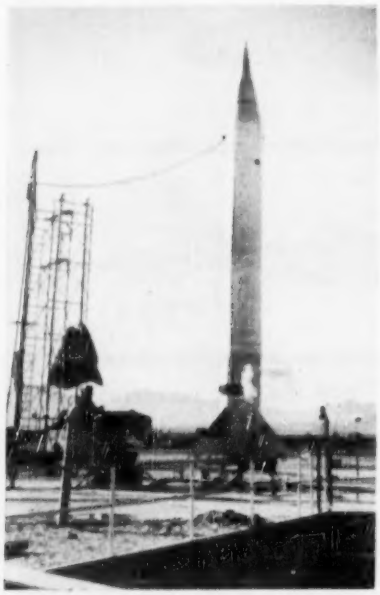
A Guide to High-Altitude Rocket Design



VIKING 5 on firing stand shows original design plan embodying high fineness body ratio and trapezoidal fins.



VIKING 9 shows design modifications to reduce fineness ratio, substitute triangular fins for trapezoidal.

With all the time and money spent on the development of powerplants, propellants and the other complex systems of any rocket, very little has been done to establish even the basic criteria for the structural design. Yet the success of any rocket vehicle can be measured in the ability of the designer to cram as much fuel and oxidizer as possible into as little structure as he can get away with.

The importance of structure weight is pointed up with an example: the Martin-NLR Viking high-altitude rocket. If 100 lb. could be removed from its structure and added in the form of propellants, the rocket's peak altitude would be increased by about 10 miles.

▶ **Basic Contribution**—One of the first additions to the literature of rocket science to consider the structural design problem in its many phases has been prepared by Richard C. Lea, structures engineer on Glenn L. Martin's Viking Rocket. Lea presented his paper at the eighth annual convention of the American Rocket Society held recently in New York.

Viking has the specific job of high-altitude research between the limits of 100 and 200 miles. Nine rounds have been fired over the past several years on a "build-and-fly" basis.

Layout is a conical nose and cylindrical fins. A gimbal-mounted Reaction Motors engine (XLR10-RM-2) running on alcohol and liquid oxygen gives about 20,000 lb. sea-level thrust. Tabs, small jets and motion of the motor steer and stabilize the rocket in its flight. Overall length is 42 ft., and diameter is 45 in.

(Viking research flights were described in AVIATION WEEK Jan. 15, 1951; a production study of the vehicle was made in the issue of Nov. 9, 1953, p. 55).

▶ **Brief Description**—Nose of the Viking, including a portion of the cylindrical body, carries the instrumentation. The forward nose section fastens with an interrupted thread for accessibility; the aft section is permanently attached, but has four non-structural doors for access. The nose is aluminum alloy except for plywood bulkheads for easy mounting of instruments.

Tank sections are welded aluminum alloy, and tankage is integral instead of separate pressure vessels within a light structure (like the German V-2, for one example).

Tail section contains more instrumentation, powerplant and control systems. About half the skin area in this section is in the form of removable doors for access.

Fins are double-wedge airfoil sections, with single-spar, conventional structure. Material is mostly aluminum alloy, with some steel and magnesium.

▶ **Primary Loads**—Rocket vehicles of the Viking type would be subject to two classes of loads: flight and ground.

Lea says that it would be desirable, for reasons of efficient structure, to make the flight loads critical for all conditions; but he quickly adds: "Not even the most zealous weight engineer would be anxious to handle and fire a rocket designed for flight conditions alone."

This is how the load categories break down on a rocket vehicle:

• **Overall shear and bending moments.** These are obtained in the conventional manner from integration of the running load over the length of the rocket body. The running load is a summation of inertia and transient loads on the rocket. Transient loads are side loads produced by gusts or motor transients at takeoff or burnout, and must be countered by the inertia of the rocket itself until the vehicle's control system can take over.

• **Local loads for detail design.** These loads, which would include such items as tank pressure and the axial loads on the shell from drag, thrust and inertia, will generally determine detail design of the shell.

• **Ground loading conditions.** The Viking is hoisted by slings, spaced to minimize concentrated loads; but the distributed weight between slings will cause bending in the shell, which could be a critical design condition. Support for transportation is also a design problem.

• **Fatigue loads.** Not normally a factor in pilotless vehicles, there are still some bits of structure, subjected to extended test periods, which require particular consideration on this score.

• **Test loads.** Before launching, a rocket may be statically tested at full or partial thrust. The tail structure must be rugged enough to take restraining forces in addition to the static loads of the support and the dynamic loads of ground winds.

▶ **Deflections, Too**—Stopping at adequate stress levels is asking for trouble, Lea says. Static and dynamic deflections in body, fins and components have to be considered.

For example, aeroelastic effects on fins could—if not properly allowed for in design—remove the fin. Flutter may come in pure bending, or more commonly by combined bending and torsion. Balancing the surface on a very thin airfoil moving at high supersonic speeds is a "new twist," Lea puns.

Within the body, varieties of deflections appear. The operating frequencies of gyros can be fed back into the control system by structural transmission, and cause considerable "noise" in the system. It isn't always practical to increase stiffness to solve this.

The high-energy rocket motor operates near avionic equipment or instrumentation; the designer may not have to worry about the operation of these latter devices, but he may be called on to solve the problems imposed by this dynamic environment.

Axial acceleration means axial deflections, of importance when mounting a sensing device like a gyro. Aerodynamic smoothness depends to a great extent on minimizing axial deflections, also.

▶ **Hot and Cold**—The rocket designer has it a bit tougher than airplane designers in problems of temperature. Bits of the rocket structure can be operating at several thousand degrees while others are down to the minus 300F of liquid oxygen.

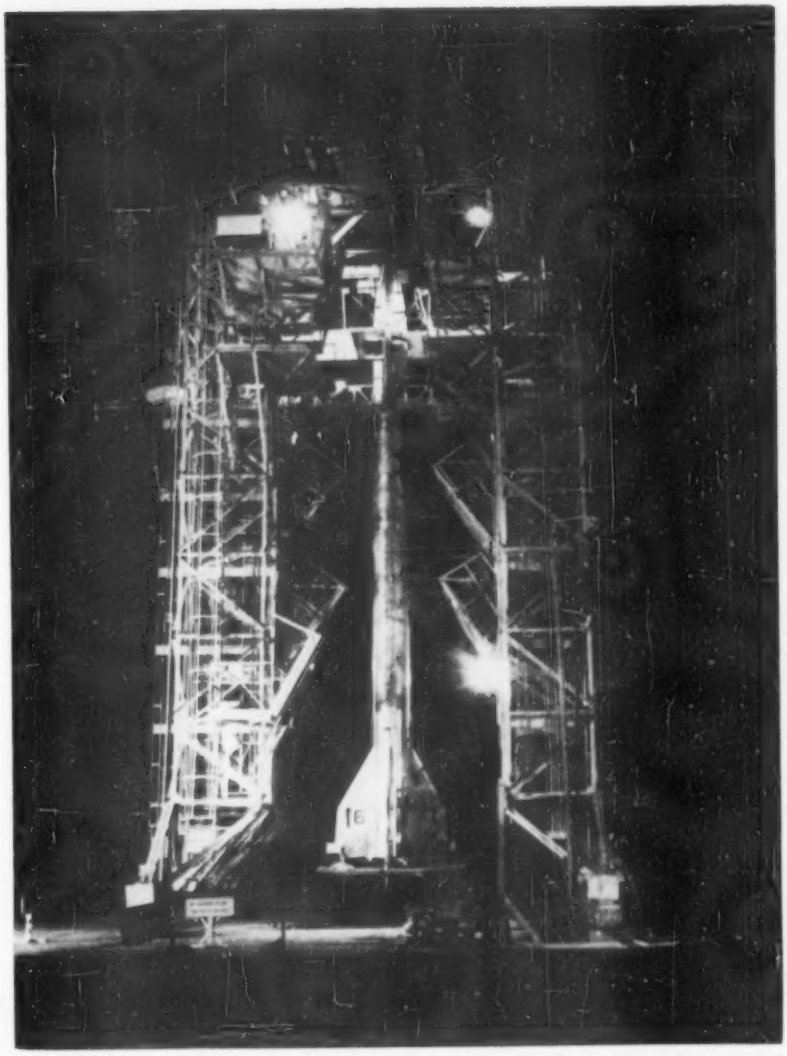
Such an extreme range of temperatures produces large deformations, high thermal stresses, and in addition influences material properties.

Reduced temperatures are less critical than elevated ones, but even so there are problems. Contraction of long tube lengths is one worry, and precooling time must be allowed during filling operations to reduce thermal stresses.

Flame temperatures in a rocket motor are of the order of 5,000F, and heat-resistant design for the motor is an obvious requirement. Turbine exhaust steam—in the Viking up around 1,200F—is ducted out of the body, and its passage near structure is another design consideration.

Wiring must be either protected or flame-resistant in some areas.

But aerodynamic heating of the outer shell is still the toughest design criterion. According to Lea, skin-temperature calculations at Mach numbers less



VIKING 6 in night firing for atmospheric research is erected in giant gantry crane at White Sands Proving Ground. By floodlight, crew works through into late evening to get rocket off in altitude flight which topped earlier tests.

VIKING REMAINS are collected after typical test. Gimbal-mounted motor and mount are visible in right foreground. Rocket is separated on downward leg into nose section and body to increase drag by causing pieces to tumble.

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than 4.0 appear to be adequate, and properties of materials under short-time elevated-temperature exposure are being better defined.

There is some help for the Viking in this regard. Its ascending trajectory blasts through the atmosphere quickly enough to avoid high heating rates; its downward descent is checked at altitude by blowing the nose off with explosives. Both nose and afterbody then tumble at reduced speeds, and heating is not a great problem.

(In the case of a tactical missile instead of a research vehicle, this downward leg is the toughest heating problem of all. Accuracy and dispersion demand a short flight time down through the atmosphere; short flight time means high speeds, which means high heating.)

▶ **Materials Choice**—Most of the Viking is built of aluminum alloys. They are readily available, easily and familiarly worked, and have a high strength/weight ratio. Aerodynamic heating on the Viking is not enough to rule them out for structure skin materials.

Aluminum is compatible with low-temperature liquid oxygen and the active hydrogen peroxide used to drive the turbine-pump combination.

But Lea spells out the prospective uses for these alternate materials:

• **Alloy steels,** for parts subjected to wear or corrosion. The higher modulus of elasticity may help reduce deflections under load, although there would not necessarily be any weight improvement.

• **Magnesium,** for bulk without weight and with medium strength. One example of this use is in the thin sections of fin structure.

• **Impregnated cloth blocks,** for lighter and more workable fillers than magnesium.

• **Plastics,** for structural and non-structural parts. Phenolic and melamine resins with cloth, paper or fibrous glass fillers are used for terminal boards, covers and supports. Vinyl and acrylic plastics are used for transparency. Teflon's dielectric properties make it valuable in avionics applications.

• **Heat-resistant materials,** such as titanium, ceramics and other special types should also be considered.

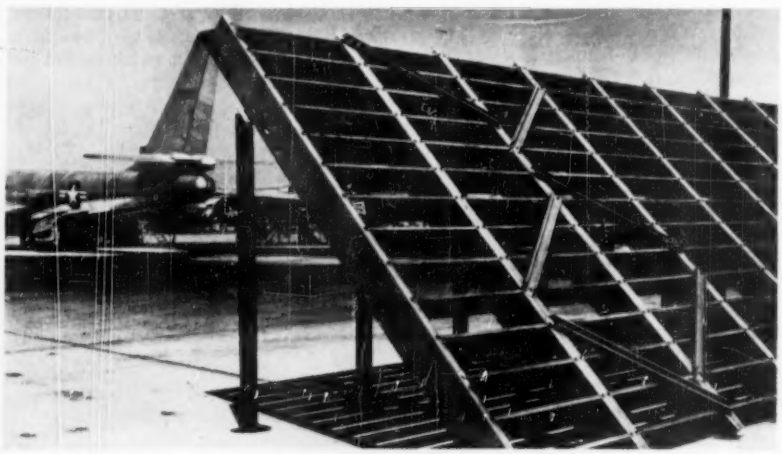
▶ **Bits and Pieces**—The detail design of the rocket applies the accumulated knowledge and determines, to a great extent, the success of the entire system.

Each of the major components has its own peculiar problems, as well as some related to the entire missile.

The forward sections of the rocket, containing instrumentation and control equipment, have to take overall axial and transverse loads. If the nose is to be sealed for instrumentation, internal pressure will be higher than atmospheric all along the trajectory. Skin and protrusions will have to withstand aerodynamic heating. Instrument mounts must be evaluated for deflections, and access for instrumentation is another headache.

Tanks are designed by combination of bending and axial loads with operating internal pressures. Internal frames may be necessary for handling and transport rather than for flight loads.

Internal conduits between tank ends —particularly in the presence of liquid oxygen—require careful consideration of deflections and care in welding. Any concentrated reactions at splices in nose or tail sections must be distributed into the monocoque tank shell.



Jet Blast Fence

Jet deflectors turn exhaust blast from six General Electric J47 turbojets in Boeing B-47E Stratojets on flight line of Boeing's Wichita plant. Deflectors are steel fences located about 100 ft. behind planes; curved vanes turn jet blast upward, avoiding possible damage to other planes or material. This picture shows rear armament of B-47 for the first time, but guns are not installed in turret.

Tail section structure must carry thrust loads and must transmit both motor transverse loads and fin stabilizing loads into the forward structure. Support structure for launching and restraint during static tests are in this section, as are powerplant and control components and the loads from these items.

Accessibility here is a design must; in the Viking, non-structural doors more than four feet long expose a 180-degree arc of powerplant viscera in a matter of minutes.

▶ **No Fins, Please**—Lea says that fins are fine for everybody but the structures man. To the aerodynamicist they furnish stabilizing means; for the controls group, they provide a place to hang the steering apparatus; the avionics people can hang antennas all over them.

But to the structural designer, they are merely weight and complication which should—and will—be eliminated from the design.

Until then, Lea says, the structure must carry high loads in minimum thicknesses without flutter, aeroelastic effects or heating dangers.

There still remain the different design considerations of handling, testing and firing equipment. Not critical from the standpoint of weight, these components and systems are important parts of rocket operation. Light weight, portability, simplicity and convenience are subordinated to operation and safety in this kind of design.

▶ **Where To From Here?**—Lea ends his presentation with a list of the difficulties which still beset rocket designers and of the needs for making that design job easier.

He states that development of structural materials and techniques along with considerations of other systems is an essential for progressive rocket design. Then he names these specific items:

• **Aerodynamic heating** above Mach 4 needs evaluation and solution by flight test measurements. Ground testing for thermal shock and the associated load-temperature characteristics could save money and weight.

• **High-temperature materials** need basic research for their improvement and development.

• **Structural feedback** by a large oscillating mass like a motor or jet vanes to the control system will continue to harass the designer.

• **Shock and impact load data** must be obtained quantitatively.

• **Fabrication and logistics** of large-diameter, thin-walled vessels give the designer considerable difficulty.

(This article is based on "Structural Design Considerations for a High-Altitude Sounding Rocket of the Viking Type," by Richard C. Lea, The Glenn L. Martin Co., Baltimore, Md., presented at the eighth annual convention of the American Rocket Society, Dec. 2-4, 1953.)

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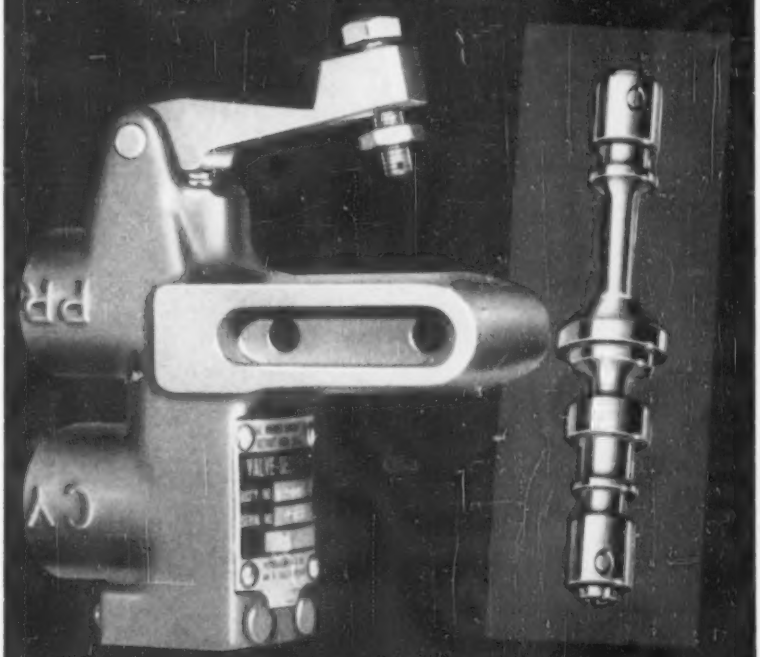

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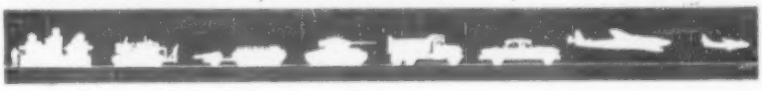

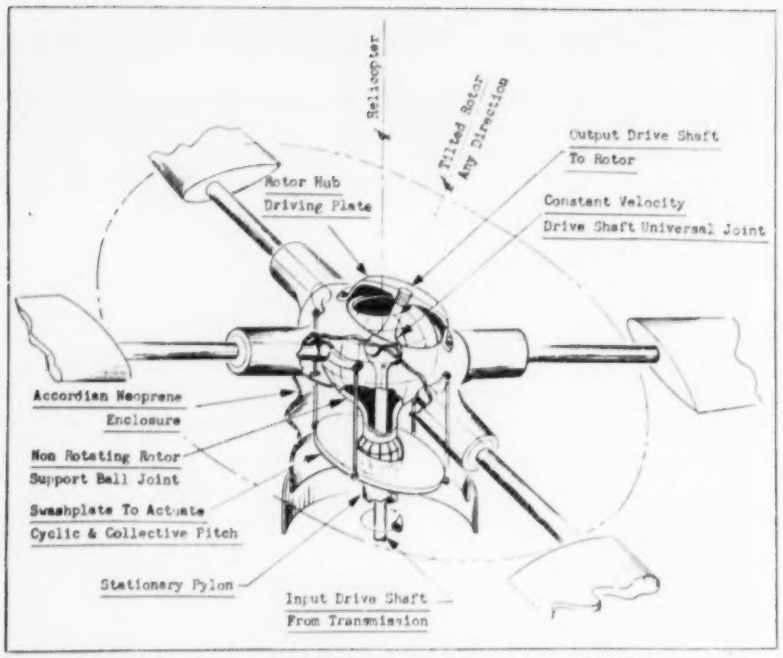
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BASIC SCHEMATIC of Doman Helicopters' rotor system helps to illustrate . . .

The Case for Constant-Speed Rotor

A young lady spinning round and round on a bar stool presents an eye-filling analogy by which Doman Helicopters, Inc., points out the advantages of the firm's rotor system.

While she rotates, she notices that she can slow down by stretching her legs out from the stool; if she brings them back toward the pedestal, she speeds up.

These actions may be amusing to her friends, says the company, but to such serious-minded technical evaluators as John Mazur, Doman's chief design engineer, her rotating mass illustrates only the law of conservation of angular momentum.

This is the scientific argument on which the Doman system is based.

▶ **The Law**—A rotating body will spin at a constant angular velocity unless an external force changes the speed of rotation. If you decrease the radius of rotation, then the angular velocity increases. If you increase the radius of rotation—as the young lady does by stretching her legs—then the angular velocity decreases.

Mazur says that when a helicopter rotor (with a horizontal hinge pin) flaps during rotation, the rotation radius of the blade mass changes and therefore the blade will accelerate and decelerate in the plane of rotation as the rotational speed increases and decreases.

▶ **Copter Vibration**—The forces that do this are generally called Coriolis forces, and they occur in an oscillating manner during each revolution of the blade. The forces feed into the rotor mast and cause vibration of the helicopter.

The Doman designer says that these forces are the major cause of oscillating stress in rotor blades, hub and mast.

"Thus, the safety and maximum speed of helicopters with hinged blades are limited by the effects of Coriolis forces, which result from lack of design consideration of the natural law of conservation of angular momentum."

ANGULAR MOMENTUM remains the same, whether pretty spinner on bar stool extends or retracts her legs. In first case, her mass rotates slower, in second, faster. This principle is applied in Doman rotor.

▶ **Objection**—Designers may object that they can give freedom of motion of each blade in the plane of rotation by the addition of drag hinges. But Mazur answers this by saying that oscillating shear loads are not eliminated by hinges, and that dampers are needed to restrain the motion of the blade. These dampers, says Mazur, destroy the effectiveness of the drag hinge and permit the destructive Coriolis forces to pass from the blades to the hub through the dampers.

▶ **Teetering Rotor**—In the case of the teetering rotor mounted on a rotating-gimbal hub, the opposite blades have a common flapping hinge at the hub. The action of such a system is similar to that of a universal joint.

In a universal, even though the driving shaft is rotating at constant speed, the driven shaft will accelerate and decelerate if there is an angularity between the two shafts. For the teetering rotor, the blades will accelerate and decelerate when the hub axis is at an angle with respect to the drive shaft. The magnitude of the accelerations will vary, increasing with an increase in hub tilt. Thus they will also increase with copter forward speed.

So, according to Mazur, forces are generated which cause a variation of bending moments to the blades in the plane of rotation. These forces are transmitted to the rotor mast, cause vibrations to the entire helicopter and eventually cause fatigue failures.

"Thus the safety and maximum speed of a helicopter equipped with teetering rotor mounted on a rotating gimbal-type hub are limited by the adverse effects which are introduced from use of the rotating gimbal-type hub."

▶ **Doman System**—The rotor system employed by Doman uses a semi-rigid teetering rotor mounted without hinges on a non-rotating gimbal. The hub is driven by a constant-angular-speed joint at the teetering center.

Mazur says that the blades will not accelerate or decelerate during each revolution, Coriolis forces will be completely absent, and rotor stresses will not be affected by CG location.

He says that the Doman YH-31/LZ-5 copter shows no evidence of vibration in flight, including the transition phase between hovering and forward flight.

Increases in size of rotor systems increase fatigue stresses and vibrations astronomically, the designer points out. But because the major sources of fatigue stress and vibration are removed in the Doman system, Mazur says that rotor system can be used "most fittingly" on extra-large copters.

Finally Mazur makes this statement: "After having flown and tested for six

years while in the employ of the U. S. Navy many present-day helicopters and after having flown in the Doman LZ-1 and YH-31 LZ-5 helicopters, (I consider) that the Doman rotor system obsoletes contemporary designs."

Focke Convertiplane Kept Under Wraps

(McGraw-Hill World News)

Sao Paulo, Brazil—Heinrich Focke of German aviation industrial fame is said on good authority to be designing a convertiplane, but details of the work are secret, as Focke is inaccessible.

The combination helicopter-plane is being designed under wraps at the Instituto Tecnologico de Aeronautica at Sao Jose dos Campos, about 100 mi. outside Sao Paulo, according to these reports. Several German technicians are working with Focke.

Air attaches at the U. S. embassy express skepticism both of the convertiplane project and a jet plane supposedly on Focke's drawing boards with the backing of some Sao Paulo industrialists.

(A check in Germany discloses no knowledge of a Focke convertiplane project in Brazil.

"I know that Heinrich Focke constructed a convertiplane a long time ago," one source says. "It is entirely possible that he is still busy on his old ideas in Brazil.")

Compact Unit Filters Corrosive Chemicals

Filters for such highly corrosive chemicals as fuming nitric acid, hydrochloric acid and hydrogen peroxide—typical liquid propellants for rocket engines—are announced by the Porous Plastic Filter Co., Glen Cove, N. Y.

Using porous Kel-F as a filter medium, the company has produced a series of inline filters which give separation of all particles larger than five microns in liquid filtration and much finer particles in gas filtration. The filter is also useful at temperatures up to 350F and is resistant to thermal shock, the company says.

In the particular filter designed to handle fuming nitric acid, makeup is of porous Kel-F elements with stainless-steel separator rings, housed in a stainless-steel container. Filter area is one square foot; envelope dimensions are 5¾ in. diameter, 6¼ in. long.

The unit will take 75 psi. differential across the element, and up to 1,200-psi. line pressures, says the company. Filters are available from fractional square-foot surface area up to 50 sq. ft.

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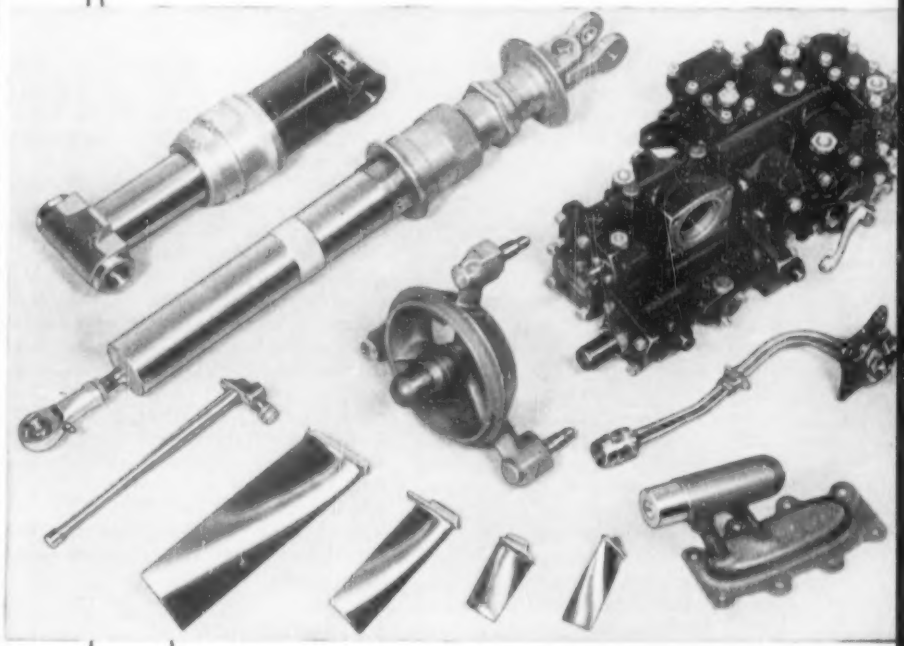

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WADC Evaluates Magnesium: Good, But–

Designers and producers must take into account the light metal's sensitivity to 'incorrect' handling.

A Wright Air Development Center evaluation of structural magnesium in aircraft says its use would reduce the cost of planes and conserve aluminum, which may be a critical material in an emergency.

But, the report points out, more or less automatic manufacturing processes and machines will have to be developed to make the light metal suitable for mass-production use. The present state of the art is believed to restrict use of magnesium in primary aircraft structures to strictly controlled conditions.

Steps already have been taken toward implementation of an all-magnesium-aircraft program. No specific details of the program have been disclosed officially, but AVIATION WEEK previously revealed (Sept. 28, p. 28) that a new trainer and a new fighter had been under consideration. In another facet of the work, East Coast Aeronautics, Inc., produced an all-magnesium F-80C fuselage, which recently concluded successful static tests at Dayton following similar tests with an all-magnesium wing. It is expected that the complete flight article will be flying by May or June 1954.

▶ **WADC's Report**—WADC's action on magnesium is based on the premise that inherent advantages of the material can be made effective only in a full-scale aircraft program, backed by adequate experience and supported with adequate equipment. In the past, use of magnesium as a primary structural material in the aircraft industry has been somewhat limited in comparison with long-established aluminum alloys.

A revised version of WADC's report—"The Suitability of Magnesium for Aircraft Structures"—omitting a few minor portions which contain classified information, is presented substantially in this article.

▶ **Mass-Production Aspects**—The scope of WADC's report concerns the technical properties of magnesium insofar as they influence the suitability of the material for large-scale use in primary structures of aircraft.

Air Force material other than aircraft is not considered, but WADC's feeling is that most other applications such as missiles, ground equipment, etc., largely will be covered by the same considerations. Requirements in these applications appear to be less exacting generally than those for primary aircraft structures, where both maximum safety and performance must be achieved at the same time.

WADC's study considers only facts which are important for a routine mass production by an adequately experienced and equipped industry. It disregards all problems arising from the introduction of magnesium, since the difficulties of transition period are not considered of primary importance for the evaluation of the possibilities offered.

Magnesium is evaluated by WADC from three points of view:

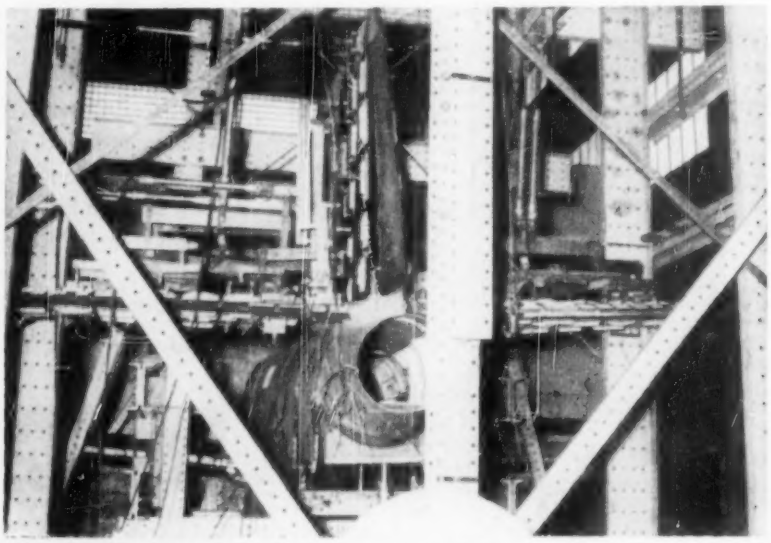
- **Performance** (physical characteristics).
- **Structural safety** (reliability).
- **Procurability** (productibility and related factors) of aircraft fabricated from magnesium.

Performance

These are the important factors under the category of performance: strength-to-weight ratio, stiffness, and suitability for use of elevated temperatures resulting from high-Mach-number operation.

- **Strength-to-weight ratio** of a complete magnesium structure appears to be equal, essentially, to that of a comparable aluminum structure, and this can be bettered in favorable applications. This conclusion in the report is based on experience gained with B-36 parts, Sikorsky helicopters, Dow-built T-6 wing panels, and also with the F-80 fuselage and wings built as all-magnesium structures by East Coast Aeronautics, Inc., Pelham Manor, N. Y., a subsidiary of Barium Steel Corp.
- **Stiffness** of a magnesium structure generally will be better than that of a comparable aluminum structure. This is because the specifically lighter and weaker magnesium generally will be used in thicker cross-sections, which means that less buckling under loads will occur.

This favorable stiffness may be an important point in favor of magnesium, the report emphasizes. Efficiently designed magnesium alloy wings will have superior aeroelastic properties permitting increased performance where



ALL-MAGNESIUM F-80C fuselage has successfully completed static tests, including overload conditions, at Wright Air Development Center. Here it is shown under test, with tail covered with tension pads. The structure was designed and built in magnesium by Barium Steel Corp.'s East Coast Aeronautics, Inc., at Pelham Manor, N. Y.

Magnesium Progress

Since its introduction into the aviation field, magnesium has taken on growing importance. This magazine has followed closely the progress made with this metal, reporting regularly on its effect on design and production. Some of the major articles on activities with magnesium, reported in AVIATION WEEK, are listed here:

- **More Magnesium Facilities Sought,** June 20, 1949, p. 41.
- **Magnesium Used as Structural Material,** July 4, 1949, p. 26.
- **Need More Magnesium Sheet Capacity,** July 25, 1949, p. 15.
- **Magnesium Alloy Corrosion Studies,** Aug. 14, 1950, p. 33.
- **How to Stretch-Form Magnesium,** Mar. 19, 1951, p. 21.
- **Magnesium: Neglected Plane Material,** Sept. 1, 1952, p. 21.
- **Magnesium: Neglected Plane Material,** Sept. 1, 1952, p. 21.
- **Magnesium Gains Favor as Plane Material,** Dec. 29, 1952, p. 31.
- **Sheet Magnesium Problem Licked,** Jan. 12, 1953, p. 40.
- **WADC to Test All-Magnesium F-80C,** Sept. 28, 1953, p. 28.
- **Magnesium Jet Trainer Design,** Nov. 2, 1953, p. 49.

flutter and aileron reversal are the limiting criteria. Use of magnesium may make possible the design of thinner wings.

• **Temperature limits** for magnesium presently are about the same as for aluminum, 250 to 300F. But the report reveals that alloys having satisfactory properties at temperatures as high as 500 to 600F have been introduced as castings in certain new engines. Also, sheet and plate alloys for use at such high temperatures are ready for service testing.

It is not yet certain that these developments will be successful, so far as use in primary aircraft structures is concerned, the report states. Problems such as riveting and corrosion-protecting these high-temperature alloys may prove critical. However, the prospect is that magnesium may find its place about midway between aluminum and titanium as a material for high-speed aircraft, the report says.

On the question of performance, the report concludes that superior designs can be achieved by employing magnesium alloys in applications where their low specific gravity, in confunction with other physical and mechanical properties, can be used to advantage.

Structural Safety

From the viewpoint of structural safety, magnesium is a material which must be used with great caution. Any deviation from the "correct" design,

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manufacturing, and maintenance rules very often will be dangerous, the report says.

This great sensitivity to abuse is a basic property of magnesium. So, while the capability to stay safely and more easily within the limits set by the material work improved, the properties of the material cannot be changed to any great extent.

Basically, magnesium has two properties which make it so sensitive to deviations from correct handling methods:

- Although the material permits a rather normal elastic deformation, it permits only little plastic deformation where it breaks.
- Magnesium has great sensitivity to corrosion.

▶ **Stress Concentration**—The low plastic deformation expresses itself as sensitivity to local stress concentration, which makes it necessary to avoid notches, abrupt changes in cross-sections, and any design involving complicated stresses which do not permit a reliable analysis of the stress distribution. Care must be taken not only in shaping the structural elements, but also in joining them together, especially when these elements have different cross-sections, the report states.

Another stress concentration factor is the material's reaction to improper riveting. This sensitivity shows up in two ways:

- When rivets are over-squeezed or over-hammered, this can locally overstrain the riveted magnesium part and result in local cracks at the rivets.
- A rivet pattern may transmit a structural load in an uneven distribution, so that certain rivets carry more than others. This condition can occur as a consequence of misalignment of rivet holes or of deformation of parts under the rivet closing pressure. Under such an uneven load distribution, the report states, magnesium structures will fail in cases in which structures of 24S aluminum alloy would simply yield sufficiently to make all rivets carry their share.

Sensitivity of magnesium to improper riveting is a problem mainly for the manufacturing shop and inspection. On the small scale in which magnesium has been used in primary structures, it has been kept under control by skillful and careful shop work. True mass production in the future probably will rely on riveting machines and devices to achieve close quality control, rather than depend on a highly skillful and careful labor operation, the report predicts.

▶ **Corrosion**—Of all structural metals, magnesium is the most susceptible to corrosion, WADC's report states. No method of satisfactorily protecting it by means of plating is in sight, it is pointed out, and flawless insulating against any outside influence is the only safe protection. Corrosion of free magnesium surfaces is not critical under normal conditions, but the material corrodes rapidly in the presence of any dissimilar metal plus any liquid acting as an electrolyte.

Yet, experience with the B-36, the Sikorsky helicopter, and the T-6 and F-80 wings show that the problem can be kept under control. On the other hand, the report points out, deviations from perfection in applying and maintaining the protective coating can be dangerous under unfavorable conditions.

Corrosion is mainly a shop, inspection and maintenance problem. It can be made easier by careful design, providing good accessibility for inspection and maintenance, and avoiding pockets where moisture and dirt might collect.

▶ **Look Into Future**—Going beyond the present state of the art, the report sees a future development coming up which may make it appreciably easier to achieve structural safety. Magnesium bonding in primary structures, if successful, may alleviate the problem of improper riveting and corrosion at points of contact with dissimilar metal.

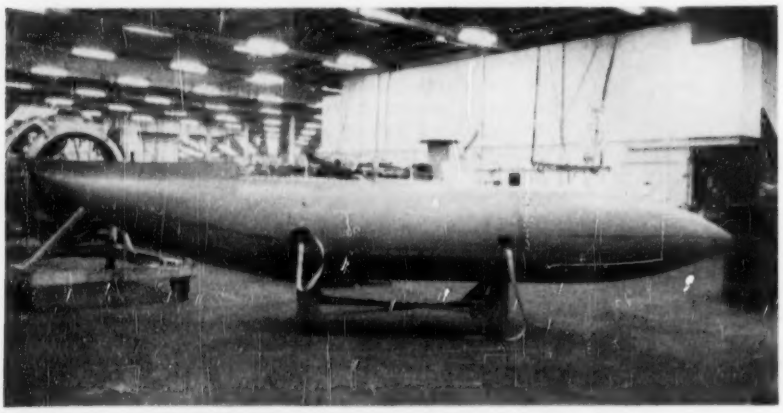
While bonding of thin sheets already has been done quite extensively in aircraft production, the procedure is not safe enough for use with thicker material, the report claims. The reason lies not so much in the properties of the bond itself, as in the inability to clean and prepare a magnesium surface so perfectly that no corroding moisture can, under any circumstances, creep between bond and metal.

The development of magnesium bonding looks very promising and should be given attention, the report points out, but there is no certainty that bonding in primary structures will work out.

▶ **Safety Conditions**—There is more operational experience with magnesium than is generally realized—a B-36 airplane has 9,000 lb. of magnesium in its airframe, and the Sikorsky H-19 helicopter is 17% magnesium (AVIATION WEEK Dec. 29, 1952, p. 31). The material has proved fully satisfactory after a period of introduction, WADC says. It gives good service even in carrier-based helicopters, which give it the roughest treatment from the standpoint of fatigue and corrosion.

The report sums up the situation on structural safety with respect to mechanical properties this way: Magnesium is a safe material for primary structures, provided designs are made with great care and manufacturing is done either with great care by skilled personnel or largely on automatic machines.

Magnesium is a safe material from the viewpoint of corrosion when it is probably protected, the report concludes. The amount of care required appears compatible with the requirements of mass-production and mass-maintenance, provided that designs are appropriate, the report points out.



Auxiliary Tank for Boeing B-52

This is one of the large external wing tanks being produced by Rohr Aircraft Corp., Chula Vista, Calif., for the USAF's eight-jet Boeing B-52A Stratofortress. Data on the tank's size, capacity, weight or number on order are classified.

Procurability

Procurability is considered by the report to fall into two categories—producibility and tcolability.

▶ **Producibility**—With respect to producibility, that is, the cost of producing the end item itself, magnesium is appreciably better than aluminum mainly because a properly designed magnesium structure generally will consist of fewer parts than an aluminum structure. This is so because the material's stiffness properties make stringers and stiffeners largely unnecessary. Also,

magnesium is extremely easy to machine.

East Coast Aeronautics says, on the basis of experience with F-80 and F9F wings, that a properly designed magnesium wing can be built with about 60% fewer parts and 25% less manhours than a comparable aluminum wing. These figures were derived from experience with a small-scale production, relying on much skilled labor and comparatively little tooling.

In true mass production, with complete tooling, riveting machines, etc., plus unskilled labor, used with both materials, a similar result might be expected, WADC feels.

Producibility disadvantages are the necessity to apply full corrosion protection to all parts and assemblies, and the need for good quality control and inspection.

The report's conclusion on costs is that one can expect an appropriately designed magnesium aircraft to be appreciably cheaper to produce than comparable designs in aluminum.

▶ **Toolability**—With respect to tooling, magnesium offers appreciable advantages for the procurability of prototypes and small operational quantities, WADC says. For small-scale production, simple sand castings can be used instead of all or most forgings—a very important consideration.

Somewhat smaller advantages may be involved for full-scale mass production. In tooling for mass production, the very strict requirements for perfect workmanship may demand rather extensive tooling, whereas a small production can avoid this problem by substituting skilled labor for elaborate tooling.

Magnesium requires a great deal of hot forming, but no additional tooling cost is expected since 75S aluminum alloy also requires it.

The cost difference between internally heated hot-forming tools and normal cold-forming tools is offset by the fact that one hot-forming operation and tool gives the same results for which two or three operations and tools are required at room temperature, the report states. —**Irving Stone**

BuAer Contracts

The following contract awards of $25,000 and more have been announced recently by the Bureau of Aeronautics, Department of the Navy, Washington 25, D. C.

GENERAL ELECTRIC CO., Schenectady, N. Y., compass adapters, 193, compass adapter mounting racks, 193, spare parts, $418,611.

McKIERNAN-TERRY CORP., Harrison, N. J., sealing strips, NAF, part No. 11-31030-2, 200, $150,000.

PHILCO CORP., Philadelphia, Pa., during fiscal year 1954 the contractor agrees to furnish to the government 600 man-months of field engineering services in connection with the assembling, altering, repairing or operating or assisting or giving instructions with respect to the assembly, installation, alteration, repair or operation of aircraft electrical or electronic equip. produced primarily by the contractor and used by the Navy. The services to be performed as required at placed within and without the continental U. S., $572,692.

RAYTHEON MFG. CO., Waltham, Mass., between July 1, 1953, and June 30, 1954, contractor to furnish 24 man-months of field engineering services in connection with the assembling, altering, repairing or operating, or assisting or giving instructions with respect to the assembly, installation, alteration, repair or operation of aircraft electrical or electronic equipment produced primarily by the contractor and used by the Navy. Services to be rendered at places within and without the continental limits of the U. S. as may be required from time to time by the Bureau of Aeronautics, $25,852.

AIRCRAFT RADIO CORP., Boonton, N. J., test bench harness AN/ARN-30 and AN/ARN-30A, 100, cable harness, ARC-16103, 100, test harness ARC-15913, spare parts, publs., dwgs., design data, bill of matl., catalog data, 100, $34,173.

AMERICAN MACHINE & FOUNDRY CO., Leland Electric Co. Div., Dayton, O., inverters, E-1737-1, 1,402, spare parts, $606,766.

CONNECTICUT HARD RUBBER CO., New Haven, Conn., design, fabricate and furnish preliminary bladder cells (1) each designed for use with a different group of the following aircraft fluids: (a) petroleum-base fluid and lubricants; (b) synthetic engine lubricants; (c) acids. Design, fabricate and furnish (1) each of the improved bladder cells for the three types (a), (b) and (c) incorporating evaluation changes. Progress and final reports, $28,403.

Bendix Builds a Better *cable clamp* the AN3057B

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The new Bendix AN approved AN3057B cable clamp is now available. Engineered by Bendix to the highest quality standards, this cable clamp offers major design improvements. The clamping action is radial and completely eliminates wire strain and chafing by holding the wire bundle firmly in rubber. This clamp will accommodate a wide range of wire bundle sizes, but an even greater range can be handled through the use of the Bendix AN3420A accessory telescoping sleeve.

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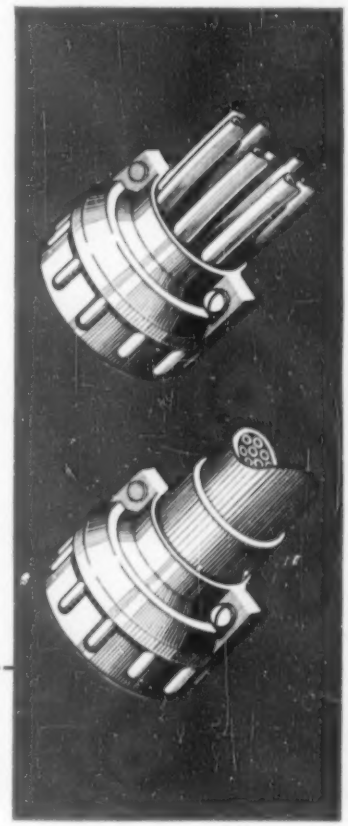

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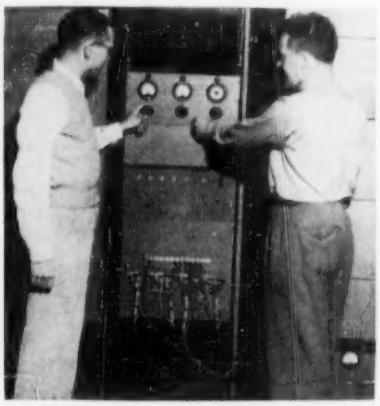
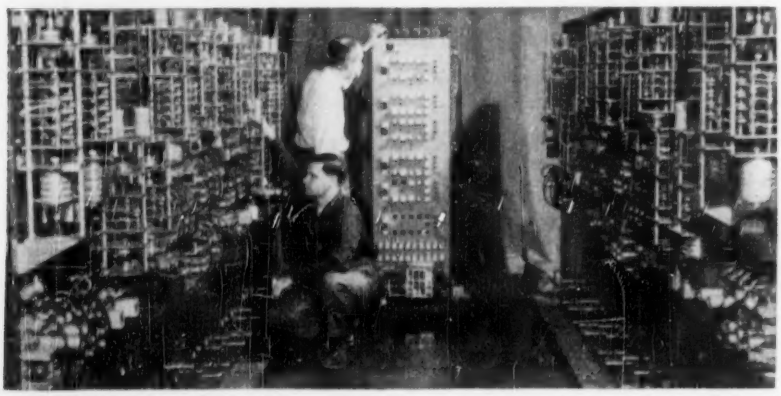
Volscan Unsnarls Airport Traffic Jam

SURVEILLANCE RADAR like this experimental unit, or more-conventional existing military or civil radars, provide plane location information to Volscan computers.

TRAFFIC CONTROLLER puts newly arrived aircraft under automatic Volscan control by placing pistol-shaped device over aircraft's blip on surveillance radar scope.



ANTRAC automatically tracks individual aircraft, in effect converting surveillance radar into many tracking radars. Antrac data is fed into Datac computers.



NEARLY AUTOMATIC traffic control of dozens of aircraft at very high rates of flow is performed by this bank of Volscan Datac analog computers, which schedule aircraft arrival.

- **USAF traffic computer lands 120 jets hourly.**
- **Unit demonstrated to civil aviation experts.**

By Philip Klass

Boston—Project Volscan, the Air Force Cambridge Research Center's solution to a pressing military problem (and one which may soon trouble civil aviation) was demonstrated here recently to representatives of USAF operating commands, the Navy, Civil Aeronautics Administration, and Air Navigation Development Board (AVIATION WEEK Dec 14, p. 7).

• **THE PROBLEM:** How to assure the orderly approach of swarms of jet aircraft, returning to base with near empty fuel tanks, so that each plane arrives in proper, close-order sequence, without delays at low altitudes where fuel consumption goes up by a factor of three.

• **VOLSCAN SOLUTION:** A nearly automatic traffic control system which determines the optimum time of arrival for each aircraft, continuously calculates the flight path that it must fly to arrive at the prescribed time.

The Volscan-computed heading and rate-of-descent instructions can be transmitted by voice radio, or automatically via a radio "data link" to a cockpit instrument in the plane. The data link signals can also be injected into the plane's autopilot so that it continuously keeps the aircraft on the required flight path (AVIATION WEEK Aug. 17, p. 342).

▶ **Missing Link**—Volscan, officially designated AN/GSN-3, is essentially a large analog computer, not a radar or instrument landing system. It forms the link between surveillance (traffic control) radar and the GCA or ILS instrument approach systems which bring aircraft in for final approach and landing.

Volscan can convert a "cloud of randomly arriving aircraft into an orderly stream" at the final approach entry point at the rate of 120 aircraft per hour for jets, 100 per hour for piston aircraft, regardless of weather conditions, according to Ben. F. Greene, Volscan project chief. (Greene received the 1953 Thurman H. Bane award from the Institute of the Aeronautical Sciences for his work on Volscan.)

▶ **By Comparison**—Using the same surveillance radar, without Volscan,

human traffic controllers can deliver aircraft at an average rate of only 30-40/hour in good (VFR) weather; many fewer in IFR weather, Greene says. The reason is that the traffic control problem is too complex and cluttered for the human mind to cope with efficiently.

The figures on Volscan's traffic-handling capabilities are extrapolated, based on the accuracy and precision demonstrated by the equipment in extensive tests at Clinton County AFB, Wilmington, Ohio, conducted in 1952-53. A variety of aircraft types, from C-45s to B-47s, participated in the test runs.

▶ **Practical Reality**—Objective of two weeks of Volscan demonstrations recently completed is to show both military and civil aviation representatives that automatic traffic control, an old concept, is now a practical reality.

AFCRC hopes to interest USAF operating commands, CAA, and/or ANDB in sponsoring development of a few Volscan systems for military-civil service tests. In production quantities, AFCRC estimates that a Volscan type system will cost around $100,000.

(AF's Rome Air Development Center is also working on the automatic traffic control problem, but is not believed to have advanced to the point of a working multi-aircraft prototype system.)

▶ **Operating Fundamentals** — Briefly stated, Volscan operates as follows:

When a new aircraft arrives in the control area (40-60 miles from the airdrome in the present design), it appears on the scope of the surveillance radar (AN/CPN-18 or civil ASR). Once identified, the newcomer is "acquired" by the action of the human traffic controller.

Volscan then instantly calculates the shortest possible time in which the newcomer could fly directly from its present position to the "entry point" for its final approach. Volscan then scans its "memory" to see whether this (earliest) time of arrival has previously been assigned to another aircraft. If this time-slot is available, it is reserved for the newcomer; if already occupied, Volscan searches for the next available time-slot and reserves it for the newcomer.

▶ **Determining Flight Path**—Knowing the newcomer's present location, and the exact time it must arrive over the entry point, Volscan next computes what flight path the plane must fly from its present position to bring it in at the prescribed time. The necessary heading and descent instructions are then visually presented to human relaymen for voice transmission to the plane, or else transmitted automatically by data link.

Volscan monitors the position of aircraft under its control at all times, continuously computing new flight path instructions on the basis of aircraft position at each instant.

▶ **Delay Path Used**—AFCRC has based Volscan design on the principle of controlling aircraft arrival time by use of a roundabout or delayed flight path, rather than requiring aircraft to increase or decrease airspeed.

Advantage of using this technique is that aircraft heading is easily and quickly changed; control of airspeed is more sluggish, involves retrimming aircraft, more work for the pilot.

One disadvantage of the delay-path technique, from the standpoint of its adoption and use for civil aviation, is its radical departure from the familiar railroad-type block separation system which the CAA now uses.

Flying under Volscan control requires no special pilot training, actually eliminates complicated holding procedures over a radio fix or on a beam leg, according to Capt. Robert W. Diez, who has made 300 Volscan runs in all kinds of weather. Volscan heading and altitude instructions are (presently) transmitted to the pilot by voice, much like GCA approach instructions. The pilot need only follow instructions. As a result, pilots like Volscan, Diez says.

▶ **System Details**—The basic elements in the Volscan system are:

• **Automatic tracker (Antrac)** isolates

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and tracks individual aircraft "blips" from the scanning radar (which has many aircraft under surveillance) and provides a continuous signal representing individual plane position. One Antrac is required for each airplane under Volscan control; a total of 14 Antracs can handle traffic at the rate of 120 aircraft/hour, AFCRC says. Each Antrac uses 19 electron tubes. The Antracs feed aircraft position signals to the schedule computer.

• **Schedule computer** calculates shortest possible (direct path) flight time (t_d) for a new plane entering Volscan control, scans arrival times previously assigned to other aircraft, then reserves earliest possible arrival time for newcomer. This scheduled arrival time (t_s) is then fed to the flight path computer.

• **Flight path computer** calculates flight path (heading and rate of descent) which plane must fly to arrive at scheduled time and produces signal proportional to required heading and altitude. One flight path computer is required for each aircraft under Volscan control; 14 are needed for 120/hour capacity. Computers are of the analog type, contain one heading channel, one altitude control channel. Combination of schedule and flight path computers is called "Datac."

▶ **The Human Element**—Although Volscan does away with human aircraft–plotting-board operators, it does not eliminate the human element entirely. In the system demonstrated, humans play the following roles:

• **Traffic controller.** This operator views the surveillance radar scope, spots new aircraft entering the area, identifies them, asks the pilot for his airspeed and barometric altitude, then sets this information (manually) into the Volscan computers. To "acquire" a new aircraft into the system, the traffic operator places the barrel of a small pistol-shaped device (containing a photocell) against the radar scope, over the desired airplane blip, then squeezes the trigger to increase blip illumination momentarily. By this action, the operator establishes the position of the new aircraft for an Antrac, setting it to tracking the new plane. When the Antrac is tracking the airplane, a small rectangular blip will appear around the airplane blip.

As presently envisioned, two traffic controllers are required to handle 14 Antracs and 120 aircraft/hour. Each is responsible for seven Antracs.

• **Relaymen.** Volscan-computed flight path instructions, in the system demonstrated, are presented on small panels (one for each plane) in front of relaymen, who radio these instructions to aircraft pilots. One relayman can handle three aircraft simultaneously, AFCRC says, because new instructions need be transmitted only periodically. Desired airplane heading is displayed on a directional-gyro type of dial-pointer arrangement; altitude information is displayed on a voltmeter calibrated in thousands of feet.

If the plane's speed should fall so low that it cannot make its scheduled time of arrival even by flying the most direct path, the flight path computer automatically flashes an "increase airspeed" light on the relayman's panel, and he radios this instruction to the pilot. The flight path computer detects this condition when it finds that the ratio of t_s/t_d is falling below a value of about 0.97.

When the plane is near the final approach entry point, the computer automatically flashes a "lower gear" light on the relayman's panel, and just prior to reaching the entry point, another light flashes and the relayman gives the pilot his final heading to the runway. The use of a data link, which is slated for military use in the foreseeable future, will eliminate the relaymen entirely.

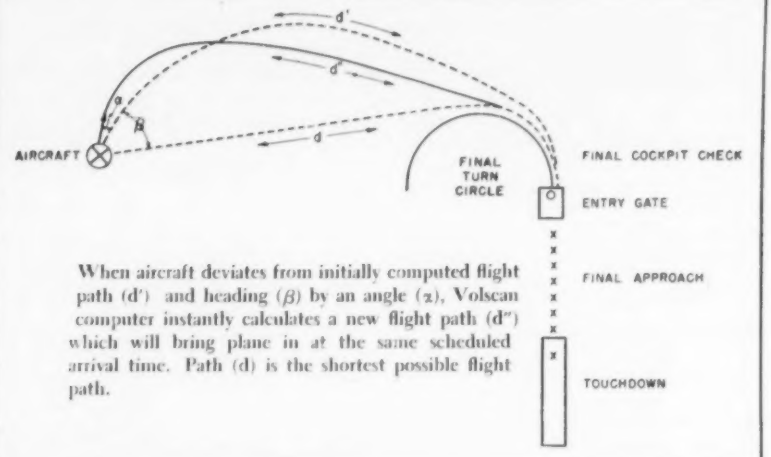
• **Monitor.** He surveys the progress of all aircraft under Volscan control on a PPI radar scope, together with a display which shows the scheduled time of arrival for each aircraft, and individual meters which show the t_s/t_d ratio for each plane. When the monitor sees the t_s/t_d ratio fall below one, for an extended period, he knows the plane will never make its scheduled arrival time and the monitor must decide what action to take.

If there is no aircraft assigned to the next later time-slot, the monitor can push a button and reschedule the plane to the new time-slot. If every one of the later slots is assigned to other aircraft, the monitor may abort the laggard and bring him out of the approach pattern (by voice instructions) for a new attempt.

Or, if the monitor sees the t_s/t_d ratio climb above 1.5, he can tell that the plane is taking much too roundabout a course and will have trouble.

When Volscan ground equipment can directly control each airplane's flight path through a data link and the plane's autopilot (as has been done experimentally), there is less likelihood of a plane deviating too far from the prescribed flight path. Nevertheless, there will still be need for a monitor and for human judgment.

▶ **Handling an Emergency**—When a disabled plane enters the Volscan control area and advises the traffic controller



When aircraft deviates from initially computed flight path (d') and heading (β) by an angle (α), Volscan computer instantly calculates a new flight path (d'') which will bring plane in at the same scheduled arrival time. Path (d) is the shortest possible flight path.

Volscan Payoff

How Volscan can slash landing and letdown times is illustrated by the following report from USAF Capt. Robert W. Deiz, 6520th Flight Test Squadron:

"One morning I took off from Wright AFB with a 300-ft. ceiling and proceeded to the Clinton County Danger Area (where Volscan was under test). In one hour and 45 minutes I had made four Volscan letdowns to VFR, in one case breaking through the ceiling at less than 100 ft.

On leaving . . . (to return to Wright AFB) I was assigned 500 feet on top, which put me at 9,000 feet. Arriving over the (Patterson) range, I was notified that since I was eighth in order, my approach time would be one hour 20 minutes hence.

"During the period of holding, three jets . . . were placed ahead. . . . It was not until one hour 45 minutes after I reported over the range that I was able to land. Volscan, 32 miles from there under the same weather conditions, could have landed all 11 of the various types of aircraft in less than 12 minutes."

that it wants an emergency approach, the controller presses an emergency button. When the schedule computer has determined the earliest time of arrival for the disabled plane, it automatically "bounces" any plane previously assigned to this time-slot.

The schedule computer then assigns the "bounced" aircraft to a new arrival time at the end of the pattern so that only one aircraft approach is disrupted by the emergency.

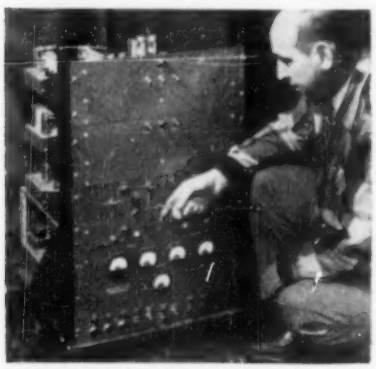
▶ **Volscan Flexibility**—Despite the prototype nature of the present system, it incorporates considerable operational flexibility and design sophistication.

For example, a single Volscan installation can feed aircraft alternately into any one of several different airports from several different final approach entry points, providing the airports are within a 20-mile radius and within radar vision. AFCRC demonstrated this feature by feeding B-29s and a B-26 into Norwood and Beverly Airports, the Weymouth Naval Air Station, and over Graves lighthouse. (Antracs and flight path computers work in a polar coordinate system, making it easy to provide for off-set entry points.)

Wind velocity and direction corrections can be set into the flight path computers, causing them to modify the computed flight path to compensate for ground winds.

▶ **Possible Improvements** – Although Greene believes that Volscan is a big advance over anything now in existence, he acknowledges that the present design could be improved in future models. For example:

• **Altitude scheduling.** At present, the desired rate of descent (determined by aircraft type) is set into Volscan manually by the traffic controller. Based on the time of arrival initially established by the schedule computer, the flight path computer calculates (and indicates to the relayman) what the plane's altitude should be at all times. This design



NEW SMALL DATAC shows how older schedule and flight path computers can be reduced in size with redesign. One Datac is required for each aircraft under Volscan control. Photo of older Datac p. 38.

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3-D Scanning

When the Volscan project was formed, its primary objective was to develop a combination surveillance and height-finding radar capable of three dimension, or "volume scanning"—hence the name. Automatic traffic control was added later as an objective, but its achievements and success overshadowed the original radar development. As now used, the unusual Volscan radar antenna provides only azimuth and range data.

approach leaves something to be desired when actual arrival time differs appreciably from initially scheduled arrival time. In a future design, altitude scheduling would be made to vary with actual flight time, Greene says.

• **Three-coordinate system.** At present, Volscan does not show the altitude of any aircraft under its control. When the monitor sees two blips approaching each other on his scope, he cannot be sure that they are at their prescribed altitudes, giving a safe separation. For maximum protection under high-density traffic use, Greene would like to see airplane altitude information displayed and possibly used in a three-dimensional Volscan computer, instead of the present two dimensional computer.

This could be done by adding a height-finder radar to the surveillance unit, but Greene thinks that the use of an airborne altitude sensor, transmitting altitude information via data link, is a better solution.

▶ **Suitable for Civil Use?**—Some observers see a basic shortcoming in the present Volscan system design which may prevent its application to civil aviation. This is the fact that there is no direct coordination nor any interlocks between individual flight path computers, to make it possible for one computer to know what the other ones are doing.

Separation between individual aircraft is solely dependent upon the fact that each is scheduled to arrive at the entry point at a slightly different time, presumably over different flight paths, and upon the alertness of the human monitor. There is no omniscient automatic device which continuously examines the airspace in three dimensions to be sure that no two aircraft are in close proximity.

Admittedly this is a difficult and complex task to perform automatically. Although the probability of collision appears remote, the possibility exists.

For military operations, this risk is much less than that present with manual traffic control operations. With increased civil air traffic, and the prospect of jet airliners, the gravity of the civil traffic control problem may be

similiar to the one facing the military.

► **Giving Volscan a Trial**—Whether the present Volscan is the answer for civil aviation traffic problems is a question for the experts to study and resolve. (Sam Saint, Air Transport Assn.'s navigation expert, was reportedly so impressed with the recent Volscan demonstration that he has scheduled a return visit when there won't be so many "visiting firemen" around.)

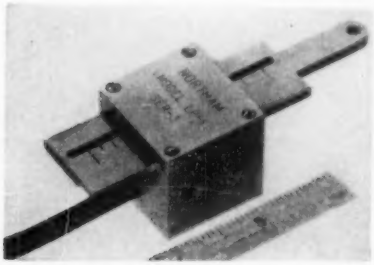
If civil authorities are interested, they can probably arrange with the Air Research and Development Command to have the present Volscan system set up in an area where it could be used for both military and civil aircraft. Greene thinks the Norfolk, Va., area would be a good one.

New Devices Aid Lab, Test Instrumentation

Equipment suitable for use in flight testing and/or laboratory instrumentation has recently been announced, including transducers, recording oscillographs and accessory devices. Details of these new units:

• **High-temp pressure pickup**, water-cooled to permit exposure to gas temperatures of 5,000F, is available for jet and rocket engine tests. Manufacturer is Control Engineering Corp., 560 Providence Highway, Norwood, Mass.

• **Linear position transducer**, magnetic reluctance type, will operate in a.c. carrier systems at frequencies of 60 to 10,000 cps., with an accuracy of 1% of the operating range, according to manufacturer. Slide travel range is ±¼ to ±2 inches. Manufacturer is North American Instruments, Inc., 2420 N. Lake Ave., Altadena, Calif.



• **Linear velocity pick-off**, with high sensitivity, consists of a cylindrical coil and a movable permanent magnet core. One model, the 6V8, with a 1-in. stroke, has a sensitivity of 450 millivolts/in./-sec. Manufacturer is Control Components Co., 46 Walnut St., Brookline, Mass.

• **High-temp impulse pickup** is used to convert mechanical motion to electrical impulses without physical contact with the moving object, providing the object is made of a magnetic material. Pickup weighs 2 oz., has output voltage of up to 28 v., 500-ohm impedence (at 1,000 cps.), and a resonant frequency of 50-60,000 cps. Manufacturer is: Electro Products Laboratories, Inc., 4501 N. Ravenswood Ave., Chicago 40, Ill.

• **Six-channel oscillograph,** type 5-117, weighs 24 lb. It is capable of recording phenomena at frequencies up to 300 cps., according to manufacturer. Device records on 70-mm.-wide photo paper, 100 ft. long, housed in a detachable film magazine. Six film drive speeds, ranging from ¾ to 24 in./sec. are available, by changing gears. Precision timing lines are recorded every 1/100th second along one edge of the record, with every tenth line heavier. A five-digit counter is advanced at the beginning of each run and photographed to provide record identification. Oscillograph dimensions are: 5¼ x 8½ x 14½ in. Manufacturer is Consolidated Engineering Corp., 300 N. Sierra Madre Villa, Pasadena 8, Calif.

• **Fourteen-channel oscillograph,** Model 557 made by Midwestern Geophysical Laboratory, has the operational features of company's Model 555 but is designed for greater ruggedness and shock resistance. Unit has full-width timing lines at 0.01 and 0.1 seconds and a beam-interrupter type of trace identification. Full-width viewing screen is

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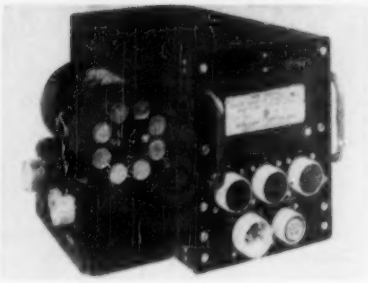
provided and record speed can be changed by means of a gear-shift arrangement. Company has also announced new Model 108 shock-resistant galvanometer whose deflection due to shock is only one-fifth as great as its predecessors, Midwestern says, enabling the galvanometer to record through shocks up to 100G. Another new galvanometer, Model 109, is designed for use in Consolidated Engineering Corp. oscillographs.

• **Oscillograph accessory**, consisting of a power supply and a three-channel demodulator unit to serve as a link between sensing elements and an oscillograph in flight test instrumentation has



been announced by Doelcam Corp. Power supply operates from aircraft's 28-v. d.c. supply and provides voltage and frequency-stabilized 400-cps. power. Voltage regulation is reported to be within 1%, frequency stabilization within 0.2%, demodulation linearity within 1% of full scale, the company reports. Address is: Doelcam Corp., Soldiers Field Road, Boston 35, Mass.

FILTER CENTER

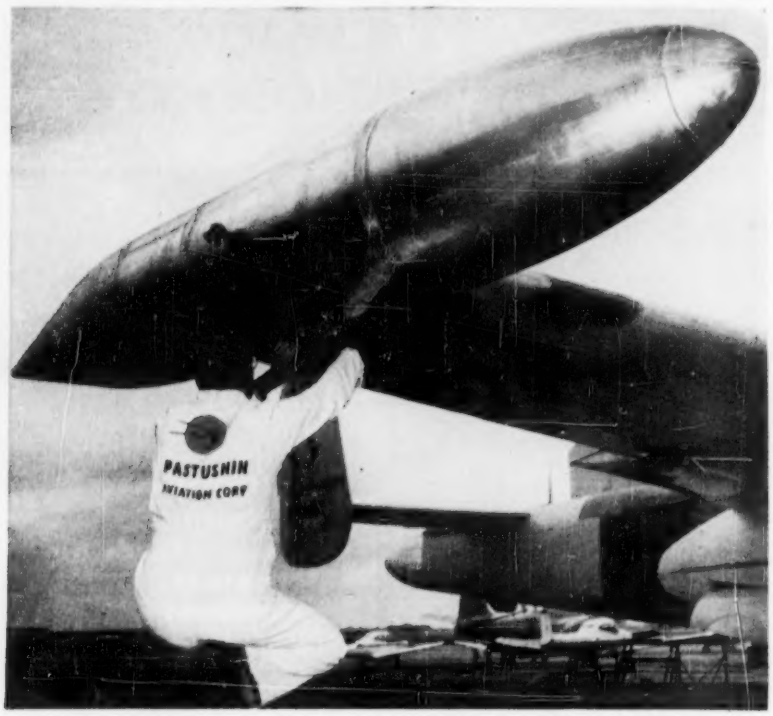
▶**M-H Sets Up Jet Flight Center**—To prevent interruption of flight test activities on automatic control equipment during the bad-weather months, Minneapolis-Honeywell's Aeronautical Division has set up a flight test center for jet operations at the Tucson (Ariz.) municipal airport. T. U. Grove, manager of M-H flight operations at Wold Chamberlain Field in Minneapolis, will head the new Tucson center. M-H will continue piston-engine aircraft flight tests at its Minneapolis facility.

▶**SRI Automation Progress**—Stanford Research Institute, which has a USAF contract to develop automatic factory (automation) techniques for producing avionic equipment, reports the design of a machine which can align and attach resistors or capacitors to etched-circuit plates at the rate of 4/10 second per item. SRI also says it has developed techniques which cut circuit-etching from 3-11 minutes to 30 seconds.

▶**New Bendix Premium Tube**—Red Bank Division of Bendix Aviation has announced a new full-wave, high-vacuum, octal-base rectifier, JAN 6106, designed to replace the 5Y3-GT and 5Y3W-GT tubes. New tube is factory-aged for 45 hours and has an extruded ceramic heater insulator and coil type heater to prevent failures from shock and vibration, Bendix says. Tube base is designed for operation without arc-overs at altitudes up to 80,000 ft. Company's address is Eatontown, N. J.

▶**Tape Resistors Available**—Tape resistors, originally developed by National Bureau of Standards and used in the recently announced Project Tinkertoy technique of mechanized electronic assembly, are now available from Sanders Associates, Inc. Especially useful in printed-circuit construction, tape resistors are rated at ¼ watt at 150C, available with resistance values of 100 ohms to 10 megohms. Company's address is 137 Canal St., Nashua, N. H.

▶**Talbott to Speak**—Secretary of the Air Force Harold E. Talbott is slated to speak Feb. 3 at Binghamton, N. Y., at ceremonies held by Link Aviation to mark the 25th anniversary of simulated flight. Edwin Link, chairman of the board, built the first simulator 25 years ago in the basement of his father's organ factory. —P.K.



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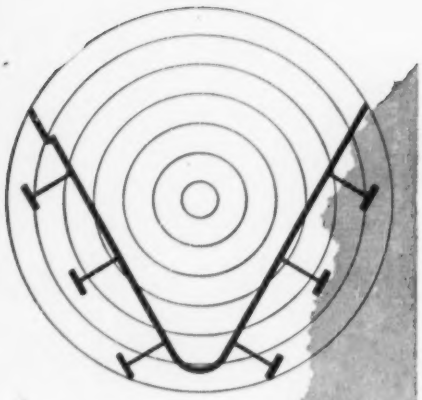

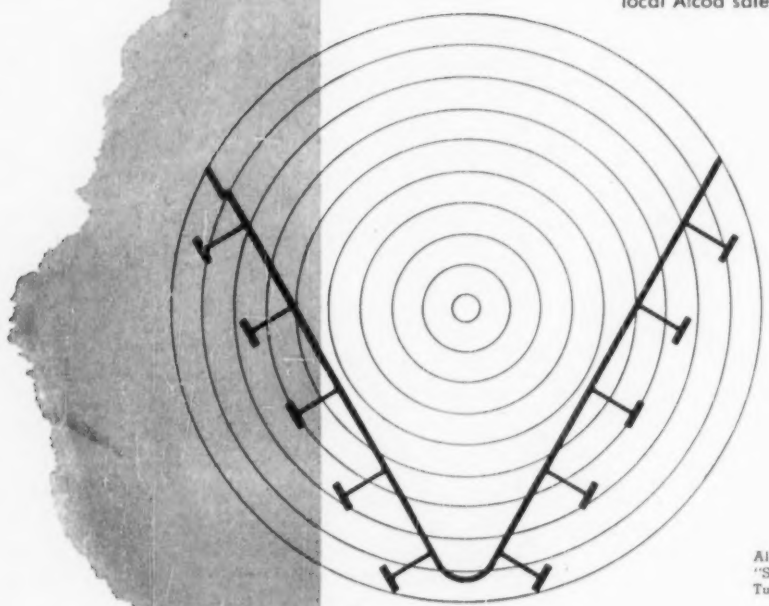

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LETTERS

Good Word for GCA

The discussions carried on in AVIATION WEEK concerning GCA versus ILS are most interesting and stimulate ideas heretofore unconsidered. "Cockpit Viewpoint" by Capt. R. C. Robson, a few weeks ago, was particularly enlightening.

Capt. Robson pointed out one disagreeable part of a GCA approach as being the necessity of having to monitor four different radio frequencies in addition to listening for GCA instructions. Assuming he refers to the normally used frequencies, I've found that, once the plane commander is cleared to GCA, any messages of an urgent nature can be relayed by GCA and the monitoring of the usual range, tower, ARTC, emergency, and, in the case of airliners, company frequencies can be eliminated or delegated to the co-pilot thus leaving the pilot free to listen to GCA only, and to carry out its instructions.

The relatively simple GCA procedure lends itself readily adaptable to multi-engine, single-engine, or jet aircraft. Commercial, military, and civilian pilots have shown this to be a good and reliable system, even for the operator who, though inexperienced in GCA, finds himself faced with the necessity of making an approach during marginal or below-minimum weather conditions. This was shown on one occasion when the writer was controlled to a successful landing in recorded weather of zero ceiling and one-sixteenth-mile visibility.

It has been shown that listening to instructions and carrying them out is less complicated than reading instruments, interpreting them, and making necessary changes, during an approach.

Thus another blow is struck in favor of GCA.

WILLIAM A. WARDE, Lt., USN
Fighter Squadron 112
San Francisco, Calif.

Designing for Safety

Your article entitled "CIR Calls for Stronger Cabins," by Frank Shea, Jr. in the Oct. 19 AVIATION WEEK will undoubtedly call widespread attention to crash survival design in air transports; Mr. Shea has done a good job in presenting some highlights on a subject of a complex nature.

I do feel, however, that it should be pointed out that our report on the National Airlines DC-6 Elizabeth, N. J., accident does not "call for stronger cabins" per se, as the headline states; the report refers, instead, to the desirability of designing the floor structure, seats and seat attachments to resist complete failure until disintegration of other major cabin structure occurs.

There may also be some misunderstanding concerning the statement (attributed to me) that forward-facing seats "have twice the retention strength of aft-facing seats". Actually, I pointed out that a person **sitting upright** in an aft-facing seat will load the seat at a higher point above the floor—because of the location of the person's CG—that he will if he jack-knifes over his belt in a forward-facing seat. In the latter case the body load is transmitted, by the safety belt, to a point closer to the floor. This results in a different leverage load being applied to the seat attachments and floor structure under like conditions of deceleration.

I think one of the most important points in Mr. Shea's article was his reference to the fact that "no fair evaluation can be made for one seat against the other until data is recorded from accidents in which both type of seats are used." As he pointed out, the accumulation of such data will require the cooperation of many accident investigating groups, not only in this country but in other countries as well.

A. HOWARD HASBROOK
Administrator
Aviation Reseach, Crash Injury Research
Cornell University Medical College
1300 York Ave.
New York, N. Y.

Your article "CIR Calls for Stronger Cabins" in the Oct. 19 issue elicits an idea, which is so simple that it undoubtedly has occurred to others.

I infer from the text, that the only method of testing the assumptions underlying construction affecting passenger safety is to wait for a "fortuitous" accident!

Why hasn't advantage been taken of radio-controlled drones, obsolete aircraft and dummies to help visualize and solve some of these problems?

GEORGE E. EVANS
Stationery Installations Dept.
The Cooper-Bessemer Corp.
Mount Vernon, Ohio

Raiding Engineers

Your article Oct. 26 on aircraft industry "pacts" to prevent competitive bidding for engineers is, from personal observation, largely true. It's high time the issues were aired!

But the article dwells heavily on methods of short-circuiting the pacts and leaves the misleading impression that they are not very effective. The pacts are working to an alarming and dangerous degree.

The real issue is whether this is (A) right and (B) beneficial. It is neither:

A. It seems to me to be basically wrong and counter to the central principle that made the United States great to stifle individual free enterprise for any segment of the population. This regulation is even worse than the (much-protested) bureaucratic kind because it is not subject to the approval of the voting public. Bum bureaucrats can be thrown out.

B. This sort of short-sighted manipulation of the axiomatic laws of supply and demand is right now depriving the industry of sorely needed technical manpower. It is therefore operating against the welfare and military security of the country. If engineers are in short supply, they should

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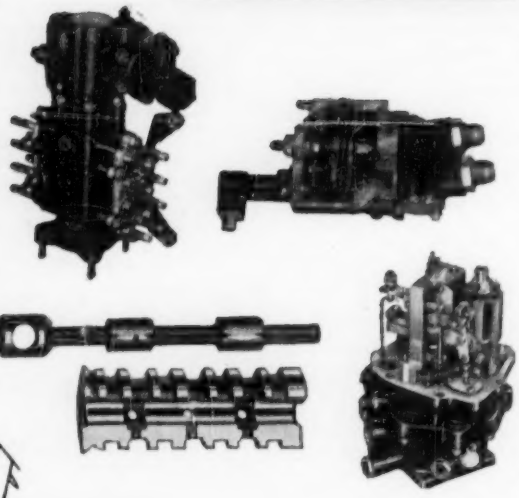

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(We are deleting the writer's name and address at his request.—Ed.)

Aviation Week Oct. 26, 1953, carried an article on pages 21 and 22 entitled "AIA 'No Raid' Pact Draws Fire."

We, of the San Diego Chapter of the Engineers and Architects Assn.-ESA, have known of this Gentleman's Agreement for some time. We have, as a matter of fact, published the story in our own newspaper and have of course been told by one of our company's management (Convair) that the story is a damnable lie. We are pleased that Aviation Week has published essentially the same facts as we did, basing them on the records of the NLRB hearings in Seattle where this story was originally brought out into the open.

Your article, in helping to expose this nefarious scheme, has been of great service to all aircraft engineers. They are the men who have suffered financially as a result of this wage-rigging agreement.

We congratulate you. You have gained the support of thousands of engineers.

Victor Hudson, President
San Diego Chapter, Engineers and Architects Assn.
San Diego, Calif.

Kaiser Metal Products

In your issue of Aug. 31, which gave excellent coverage to the first flight of the B-57A at the Glenn L. Martin plant in Baltimore, your reporter refers to this company as the "Kaiser Metal Products Div." This is an error which might logically be made by anyone unacquainted with the various Kaiser companies.

Kaiser Metal Products, Inc., is an independent, separate corporate entity and is not a division or subsidiary of any other Kaiser organization. It will be appreciated if you'll call this to the attention of your reporters and copy desk.

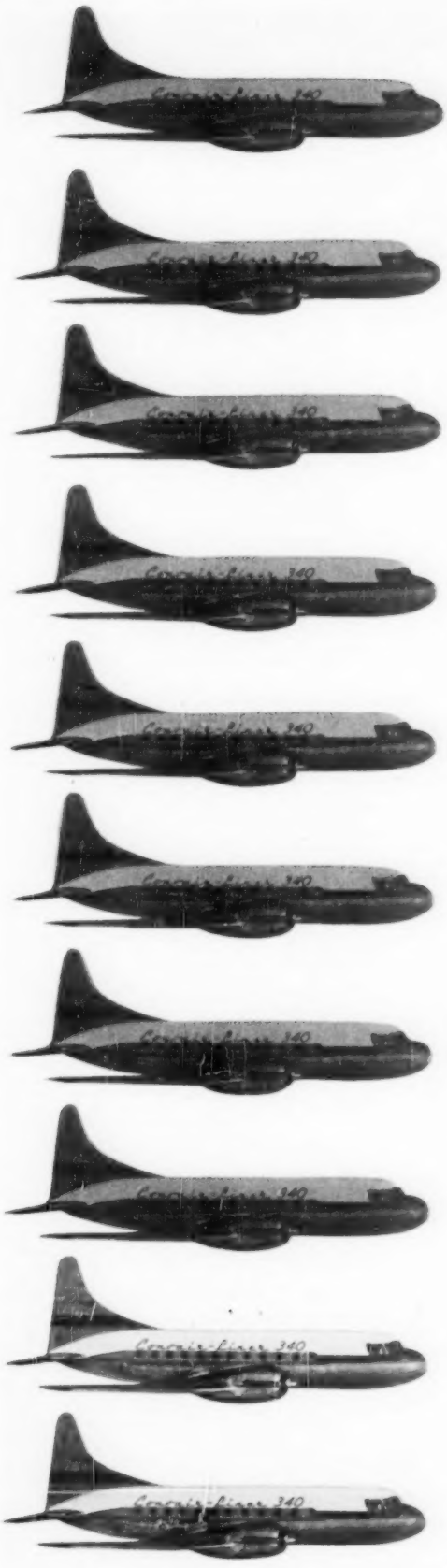
John H. Wintersteen, Manager
Public Relations & Advertising
Kaiser Metal Products, Inc.
Bristol, Pa.

Bush Operation

I would like to take this opportunity of telling you how pleased I am with the article you wrote on our operation ("Bristol Freighter Paces Bush Operation," Aviation Week Sept. 7, p. 72).

It is easy to get publicity of the spectacular type; however, we frown on this type of write-up, as I am sure other sound operators do, as the industry has outgrown the "glory" stage and we think it is now a sound business. It is, therefore, very gratifying to think that your magazine considered details of our operation of sufficient interest to publish.

T. P. Fox, Manager
Associated Airways, Ltd.
Edmonton, Alberta, Canada



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The second of two articles on profits

What Are PROFITS Used For?

This is the second article on the role of profits in our economy. The first was addressed to the question: "How High are Profits?" The answer was found to be: not high when compared with previous years and the present investment in corporate facilities. This second article is addressed to the equally important question: "What do corporations do with their profits?"

In 1953 corporations will earn about $20 billion *after taxes*, if the recent rate of earnings is maintained throughout the year. These profits will be used (1) to expand and improve productive capacity through purchases of new plant and equipment, (2) to finance the operations involved in a growing volume of business and (3) to reward the people who have invested their money in American industry. Of the $20 billion, the corporations will pay about $9 billion to their stockholders as dividends. They will use the $11 billion that remains to purchase new plant and equipment and to increase their working capital.

This year corporations are increasing their plant, equipment and working capital by a total of approximately $32 billion. Of this amount, about $26 billion is for new plant and equipment. The remainder is for working capital. As this article will show in greater detail, about $21 billion of this will come from depreciation allowances and sales of new securities. The other $11 billion will come from retained profits.

It is impossible to trace exactly how each dollar of retained profits is spent. This money is mixed with other money that goes into the company treasury in the form of proceeds from loans, sale of securities and depreciation allowances. *However, it is a fact that by retaining $11 billion of their profits this year, corporations have provided $11 billion toward their total capital requirements, including the money needed for expanded and improved capital equipment.*

Profits Mean New Plants

This year American industry is engaged in a very large expansion of plant facilities. This will increase the industrial capacity of the nation by about 7 per cent. Since 1950, our capacity has been increased by about 12.5 per cent. And all of this expansion has been privately financed, even though about one-third of it was certified as necessary for national defense.

The expenditure during 1953 of $26

billion for new plant and equipment—an alltime record—imposes terrific financial responsibilities on our corporations. About one-half of the amount required will come from depreciation allowances. In general, these allowances are supposed to pay for the replacement of worn-out or obsolete equipment. Another $8 billion will be raised by corporations through new security issues and long-term mortgage loans. All together, depreciation allowances, security issues and long-term loans will provide about $21 billion. But this is still $5 billion short of the $26 billion needed for new plant and equipment this year. Thus, it is retained profits that spell the difference between expansion and standing still, between growth in the productive capacity of the economy and running downhill.

As plant facilities are expanded, corporations also need more working capital. A larger volume of business requires larger inventories, larger accounts receivable and larger amounts of ready cash to meet payrolls and bills for materials. The increase in these items during 1953 is estimated at $8.5 billion, of which about $2.5 billion will be supplied by short-term bank loans. The other $6 billion will come from retained profits. Thus, retained profits provide an essential $11 billion—$6 billion for working capital, $5 billion for new plant and equipment—to meet corporate financial requirements.

Incentive for Investment

The role of the profits that are paid to stockholders as dividends or to employees under profit-sharing plans is even more important than the role played by retained profits in providing plant, equipment and working capital. Dividend payments provide the main incentive for investment in the stocks of corporations. They are the reward for risks taken by investors. Dividends paid by corporations whose common stocks are listed on the New York Stock Exchange provide an average return of about 6.5% at present prices, and dividends on preferred stocks average about 4.5% return. Dividends are distributed among 6.5 million stockholders. Also, it is estimated that 3 million employees now are covered by profit-sharing plans. These plans increase the incentives of both production workers and managers to work harder and more efficiently.

Thus, more than 9 million Americans have a *direct* financial stake in corporate profits through ownership of stock or participation in profit-sharing plans. But *all* Americans share indirectly in the rewards of a successful business year. Investment of a major part of 1953 profits in new plants and equipment means more employment opportunities and better working conditions for labor. For the nation, it means new industrial capacity that is essential both for national defense and to produce more and better goods for a rising standard of living.

Corporate profits after taxes represent about 6% of the nation's total income. But the job they do to stimulate investment and to finance industrial expansion and improvement is more far-reaching and more essential to the prosperity and well-being of the American people than would be suggested by that small figure.

McGraw-Hill Publishing Company, Inc.

Airline Revenues Soar to All-Time Highs

- **New peaks forecast by ATA for coming year.**
- **Scheduled carriers plan to expand fleets 10%.**

By Lee Moore

Airline revenues and profits soared to all-time highs this year, and Air Transport Assn. predicts higher revenues during the coming year.

U. S. airline traffic and revenues will increase about 10% in 1954, ATA predicts. This compares with a 14% revenue gain and 16% traffic volume gain from 1952 to 1953.

Profit margins in late 1953 and all of 1954 will be lower than the 1950-52 highs, ATA believes. Heavy deliveries of new aircraft are causing a drop in load factor (payload as a percentage of capacity), and, at the same time, higher expense allowances to amortize the new equipment. But airlines counted on this when they ordered the new planes to ease their former equipment shortage.

Despite revenue gains, domestic trunkline operating profit may have dropped slightly in 1953, from $95 million last year to $92 million in 1953, ATA forecasts, for the reasons cited above.

U. S. international carriers' profits increased sharply, however, largely because Civil Aeronautics Board put so many international routes on final subsidy rates with profit, whereas most internationals previously operated on temporary, break-even subsidy rates. Retroactive profit increases may bring previous years nearer to the 1953 showing.

► **$200 Million for New Planes**—The 1954 forecast for all the world's scheduled airlines (except Communist and a few other minor operations) is a 10% payload increase over 1953. International Air Transport Assn. also estimates that member airlines will expand their capacity 10%. IATA's 69 lines carry 85% of the world's commercial air traffic.

Airlines probably will spend about $200 million for 300 new transports scheduled for delivery during 1954 alone, IATA says.

► **1953-54 Forecasts**—Here are other year-end airline business developments and forecasts:

• **Net profits** of 10 major U. S. airlines (see table) gained 30% in the 12 months ending Sept. 30—1953 vs. 1952.

• **Revenues** reported by the same 10 carriers gained 17% in the same period.

• **Trunkline passenger revenue** in 1953 climbed $100 million or 15% from a year ago. A slightly lesser gain is anticipated for 1954.

• **Trunkline mail revenue** gained $500,000 or 2% in 1953. The growing Post Office Department experiment of shipping preferential first-class mail between major cities by air instead of rail where costs are competitive is expected to boost mail revenues next year, despite decline of military mail.

• **Trunkline express revenue** increased about $1 million or 11% and should continue increasing.

• **Trunkline freight revenues** in 1953 increased $3 million or 12%.

• **Total trunk operating revenues** climbed $107 million or 14% to an estimated $875 million.

• **Trunk operating expenses** gained $110 million or 16% to $783 million in 1953.

• **Trunk operating profits** may have declined a slight 3%, ATA predicts—from last year's $95 million to an estimated $92 million in calendar 1953. Net profits are not predicted, because of the complexities of year-end accounting adjustments.

• **World traffic forecast** for IATA carriers is a 10% gain in 1954. In 1953, they carried more than 50 million passengers 28 billion passenger-miles, while cargo volume was 685 million ton-miles and airmail 190 million ton-miles. All will continue expansion in

Record Airline Profits in 1953

(10 selected carriers, 12 months ending Sept. 30)

	1952	1953
	(000 omitted)	
American:		
Revenues	$180,610	$204,988
Operating profit	23,057	29,078
Net profit	**10,690**	**13,739**
Eastern:		
Revenues	111,214	141,481
Operating profit	15,624	20,733
Net profit	**5,384**	**9,820**
Capital:		
Revenues	38,950	45,260
Operating profit	1,846	3,644
Net profit	**1,243**	**1,758**
National:		
Revenues	26,818	34,395
Operating profit	4,088	4,597
Net profit	**2,322**	**4,121**
United:		
Revenues	146,891	166,933
Operating profit	24,862	21,065
Net profit	**10,081**	**10,445**
Western:		
Revenues	17,227	21,832
Operating profit	2,766	2,742
Net profit	**1,120**	**1,278**
Northwest:		
Revenues	53,694	61,736
Operating profit	(—111)	4,473
Net profit	**1,283**	**2,681**
Trans World:		
Revenues	153,794	185,076
Operating profit	16,033	16,158
Net profit	**8,524**	**7,144**
Pan American:		
Revenues	185,578	206,475
Operating profit	5,680	17,950
Net profit	**6,714**	**10,816**
Flying Tiger:		
Revenues	6,505	7,857
Operating profit	1,209	1,225
Net profit	**1,330**	**1,698**

Source: Carriers' Form No. 41 reported to Civil Aeronautics Board.

Domestic Trunk Airlines Revenues & Profits

Calendar 1952-53

	1952	1953
Passenger revenues	$671,257,035	$771,470,956
Mail revenues	35,910,283	36,375,006
Express revenues	15,852,661	17,605,289
Freight revenues	25,529,528	28,672,572
Total operating revenues	768,014,593	875,196,378
Total operating expense	672,898,899	783,246,282
Operating profit	95,115,694	91,950,096

Domestic Trunk Traffic

			% change
Revenue passengers	22,768,174	26,068,731	+14.5
Revenue passenger-miles	12,120,789,000	14,273,347,000	+17.8
Mail ton-miles	68,296,296	72,288,321	+5.8
Express ton-miles	40,375,164	43,848,549	+8.6
Freight ton-miles	117,128,101	131,813,350	+12.5
Total revenue ton-miles*	1,413,459,651	1,643,380,074	+16.3

* Total ton-miles include nonscheduled, charter operations not shown in breakdown above the total.

Source: Air Transport Assn.'s year-end forecast by ATA economics director L. C. Sorrell. Calendar 1953 estimates are based on projections of financial data January-September and traffic volume January-October tempered by informal data indicating slowdown in growth in the final months.

1954, according to IATA director general Sir William Hildred.

• **IATA revenue increase** will not quite match the predicted 10% gain in 1954.

"Creative fares and rates will help swell the volume of passengers and cargo next year, but these same lower fares, combined with extensive re-equipment costs and decreased compensation for carrying airmail will keep the balance of airline finances generally precarious," Sir William explains. "The international airlines remain confident that the world economic situation will continue to improve, and the present high level of activity will be maintained."

"Nevertheless," ATA says, "the last half of 1953 gives evidence that the rates of traffic increase are themselves decreasing and produces the prospect that in 1954 the industry increase will be much lower than recently enjoyed.

"The trunklines have scored another impressive gain on their rail competitors, but a short while back it was customary to measure the annual progress against the Pullman traffic of the rails only," ATA says. "Five years ago airline traffic was slightly more than half of the Pullman. In 1953, it was approximately 70% greater than the Pullman, and approximately one-half of the total rail, traffic coach and Pullman—but excluding rail commutation," ATA adds.

"Airline coach traffic also continued to gain rapidly," says ATA, pointing out that "in 1952, coach was about 20% of the total: During the last year it climbed to 30% of trunk passenger traffic."

American Starts First U.S.-Mexico Aircoach

(McGraw-Hill World News)

Mexico City—American Airlines faces early competition on its recently inaugurated aircoach service to Mexico.

Observers here expect Pan American World Airways to begin flying tourist service from Houston to Mexico City to meet AA's aircoach challenge. But there is no official confirmation here.

► **American Service**—American this month became the first carrier to start coach service to Mexico, flying 80-passenger DC-6s daily from New York and Chicago to Mexico City.

Fares on the new service undercut first-class rates as much as 40%, a slash the carrier predicts will open an entirely new air travel market to Mexico and greatly increase tourist business that so far has averaged approximately 400,000 persons annually. AA has carried some 80,000 of the total each year.

Aircoach rate from New York to Mexico City is $99 compared with $145.40 on regular flights. On the Chicago-Mexico City flight, the fare is $76—nearly 50% less than the first-class charge of $114.

► **Passenger Backlog**—American sees only one flaw in its potential traffic buildup: Civil Aeronautics Board has limited takeoffs from 7,600-ft.-high Mexico City Airport to 65 persons.

The carrier fears this restriction on return flight to the U.S. will cause an accumulative aircoach passenger backlog.

► **Competing Lines**—Other competition to AA's aircoach challenge could come from Trans-Canada Air Lines, which has won its fight to fly from Montreal and Toronto to Mexico City via Tampa, Fla. Other foreign air carriers flying into this city: Canadian Pacific Airlines, Air France and KLM Royal Dutch Airlines.

Philippine Airlines was scheduled to begin service this fall from San Francisco to Mexico City, but PAA affiliate Campania Mexicana de Aviacion won an injunction from a Mexican court restraining PAL from operating the route—previously approved by government authorities. The injunction was granted on grounds that Philippine's permit was not ratified by the Mexican senate and thus was not valid.

U.S., Canada Sign New Air Agreement

Toronto—Trans-Canada Air Lines will begin flying from Montreal and Toronto to Mexico City via Tampa, Fla., Jan. 2 under a new agreement reached by U. S. and Canadian air transport officials.

The six-month agreement permits government-owned TCA to land at Tampa en route to Mexico City, a right that was denied by Civil Aeronautics Board shortly before the carrier was scheduled to inaugurate the service Nov. 1 (AVIATION WEEK Nov. 23, p. 18).

After the U. S. granted Trans-Canada a license to operate one-plane service on the new route, the Canadian Air Transport Board called off hearings ordered against Pan American World Airways and Colonial Airlines.

The two U. S. carriers were scheduled to show cause Jan. 15 why Canada should not cancel rights on parallel stops made on through routes (AVIATION WEEK Nov. 16, p. 15).

Meanwhile, Transport Minister Lionel Chevrier says U. S. and Canadian air transport officials will review route schedules and license new services.

One under consideration: direct flights from Toronto to Washington.

BOAC Reports High Revenues for DC-4M

Withdrawal of all Handley Page Hermes airliners is "the most noteworthy single step" British Overseas Airways Corp. has taken in the past year, BOAC chairman Sir Miles Thomas reports. Sir Miles forecasts replacement of the Hermes on the East African route by Canadair DC-4M Agronauts will increase BOAC's revenue by about $1,405,000.

Argonauts have made the East African route a paying proposition after the airline operated it at a loss many years.

Roof Heliport

- **New design uses cable tows, landing turntables.**
- **Capacity is estimated at 40 copters hourly.**

Helicopter manufacturers, airlines and city managements now studying heliport design requirements for the 1960s may consider an old idea with a new twist.

A patent applied for by S. Tebbs Chichester, Jr., industrial interiors designer in Washington, D. C., proposes an automatic cable-tow system to move big copters from a landing turntable to any one of several available loading platforms, then onto the takeoff area. The proposed system is in effect a combination of San Francisco cable-car and Navy aircraft carrier techniques.

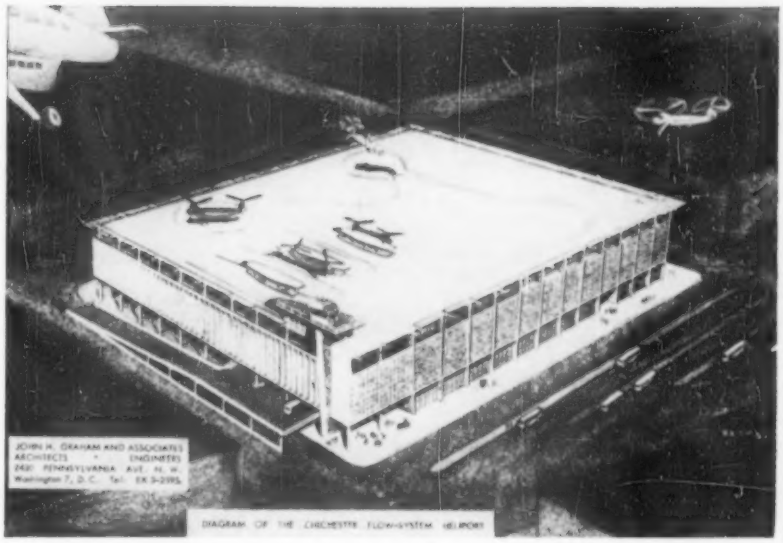
▶**Solutions Proposed**—Chichester's idea stems from his belief that this may help meet several problems that will be associated with handling of frequent landings and takeoffs of big (40-50 passenger) copters in small downtown heliports:

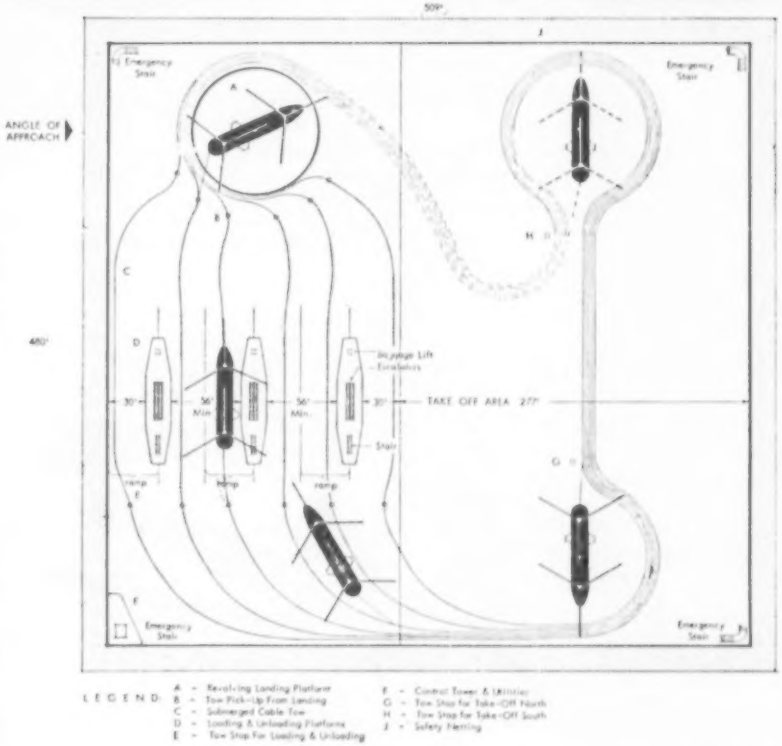
- **Noise and wind** annoying passengers and ground crews when the big copters taxi under their own power.
- **Ground risk** of accident during taxi operations in the crowded and confined area of city heliports.
- **Fuel consumption** from taxi operation.
- **Rapid handling.** Chichester claims that his system probably can meet the Air Transport Assn.'s tentative requirement of about 40 or more takeoffs and landings per hour at some city heliports.

▶**How It Works**—Chichester proposes that the helicopter land on or taxi onto a turntable, then kill or idle its engine. Ground operator turns the copter to put its nose next to the cable pickup belonging to the intended loading platform.

Ground crew (which could be the cable operator) hitches the cable to the nose, and the copter is moved to the loading platform.

When the copter is loaded, the cable is reactivated and moves the copter to takeoff spot. The circular course of the cable around the takeoff area permits the pilot a selection of headings before he releases the cable and takes over under the copter's own power. Chichester's preliminary idea drawing (see diagram) contemplates three separate loading platforms, giving a theoretical peak capacity of eight copters at once on the automatic cable system of the heliport—one landing, six in the loading stalls and one taking off.





▶**Ground or Rooftop** — Chichester's original patent application cites a possible rooftop location, and his calculations indicate that a typical large office building is big enough to accommodate a three-platform system of the type he proposes.

Chichester's proposal is one long-range attempt to foresee the heliport cost and passenger acceptance requirements for such a heliport.

▶**Other Studies**—Other groups and individuals are attempting to forecast heliport requirements, which also have a direct relationship to future helicopter design and necessary safety regulations.

The industrial engineering design firm of Burns and Roe in New York recently placed two men on a full-time study of the outlook for heliport requirements from 1956 on. Air Transport Assn., New York Port Authority and other groups are engaged in similar and allied studies.

A central clearing house for heliport plans is the Aircraft Industries Assn.'s helicopter council and its heliport committee, to which Chichester plans to present a paper next month outlining his ideas. —LM

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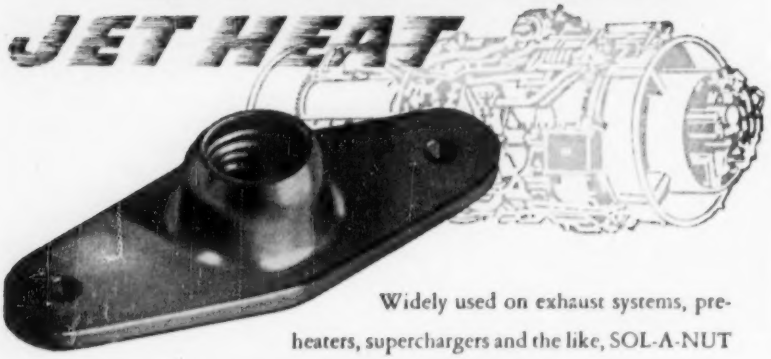

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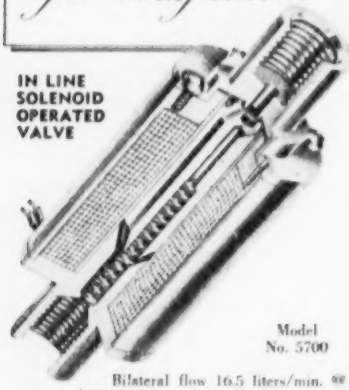

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CAB ORDERS

(Dec. 4-16)

AUTHORIZED:

Southern Airways to suspend service at Clarksdale, Miss.

Delta-C&S Air Lines to suspend service temporarily at Kingston, Jamaica.

DENIED:

Delta-C&S application for temporary suspension of service at Greenwood, Miss.

Great Lakes Airlines made application to fly Burbank-New York and/or Philadelphia, New York-Miami, Oakland-New York and/or Philadelphia, Seattle-New York and/or Philadelphia and San Diego-New York and/or Philadelphia from Dec. 12 to Jan. 17.

CONSOLIDATED:

Mail rate proceedings of Trans-Pacific Airlines and Hawaiian Airlines.

FIXED:

Mail rate of Inland Air Lines.

ORDERED:

Temporary exemption until July 7, 1954, for Purdue Aeronautics Corp. to use a C-47 aircraft for 600 hr. in interstate transport of persons and property on a charter-trip basis.

Temporary exemption of Allegheny Airlines from servicing Cumberland, Md., and Altoona, Pa.

GRANTED:

Pioneer Air Lines permission to use Abilene (Tex.) Municipal Airport as of Dec. 15.

Lake Central Airlines exemption until Jan. 1, 1955, to engage in air transport of persons, property and mail to and from Lima, Ohio.

Niagara Falls, N. Y., permission to intervene in New York-Chicago service case.

DISMISSED:

Proceedings in the matter of coach fares of American Airlines and Eastern Air Lines.

APPROVED:

Allegheny Airlines application to omit Butler, Pa., on certain of its flights.

Mail rates of Central Airlines and Trans-Texas Airways.

SHORTLINES

► **Air Transport Assn.'s** new officers of the airline finance and accounting conference for 1954: John S. Woodbridge, comptroller for Pan American World Airways, president; Todd G. Cole, vice president-comptroller, Delta-C&S Air Lines, and J. J. Taylor, vice president-treasurer, Western Air Lines.

► **Aquila Airways** has been authorized to inaugurate service between England and Capri, with the first experimental flight set for April 1954. Regular service probably will follow in May with

six hours flying time between Southampton and Capri.

▶ **Central Airlines** plans to employ stewardesses instead of male pursers.

▶ **Lake Central Airlines** has been authorized by Civil Aeronautics Board to serve Lima, Ohio, on its east-west segment between Kokomo, Ind., and Marion, Ohio.

▶ **North Central Airlines'** application to suspend service at St. Cloud, Minn., for lack of passenger patronage has been denied by CAB in favor of an investigation of the entire route segment to determine whether the public convenience and necessity require continuation of local air service between Minneapolis-St. Paul and Fargo, N. D., and between the Twin Cities and Grand Forks, N. D.

▶ **Pioneer Air Lines** has moved its operations from Tye Air Force Base, Abilene, Tex., to the new Abilene Municipal Airport. Pioneer had used the Tye base since May 15, 1952.

▶ **Riddle Airlines** has begun daily Miami-New York cargo flights.

▶ **Seaboard & Western Airlines** logged 630,350 revenue flight miles in 3,185 flight hours during October. The airline made 4,689 ocean crossings during the month and reported commercial and military operations 4% higher than during October 1952.

▶ **Transocean Air Lines** is beginning weekly service between Kabul and Cairo. Intermediate stops will be made at Kandahar, Afghanistan, and Jerusalem.

▶ **Transport Air Group,** airfreight association, has proposed to Institute of the Aeronautical Sciences that a cross-section group of military and civil airfreight industry sponsor an intensive study of indirect costs, largely those for freight loading.

▶ **Trans World Airlines** has filed a complaint with CAB against Trans World Tour and Travel Service for its use of the name Trans World.

▶ **United Air Lines** will have carried approximately 17,000 passengers on its New York-Chicago "executive" (all male) flights by the end of 1953, the airline forecasts. . . . UAL flew 206,633,000 revenue passenger miles in November.

▶ **Western Air Lines** request to stop service to Spearfish, S. D., is recommended for CAB denial by examiner Paul Pfeiffer.

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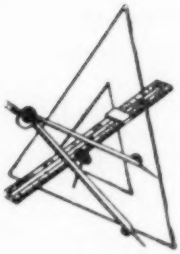

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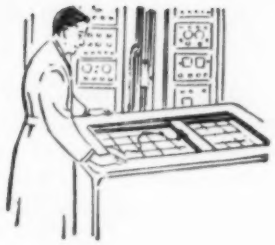

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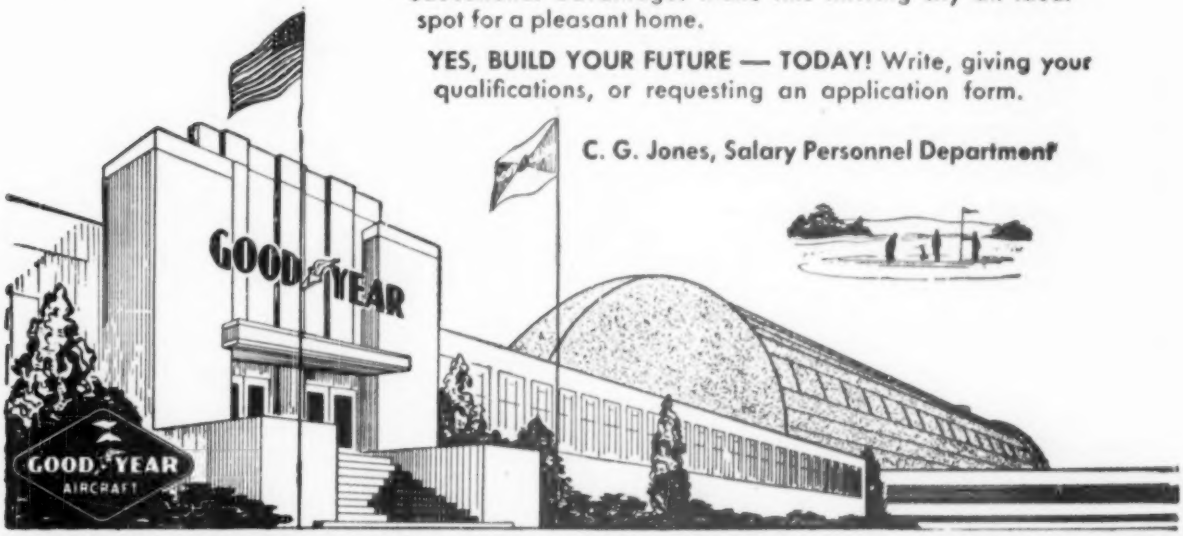

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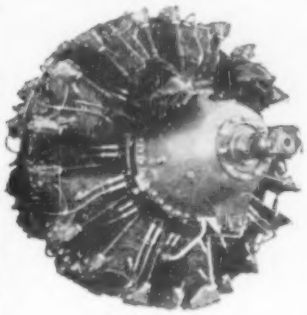

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Blower	Joy Manufacturing Co.	U-702-15	24
Tank Unit	Minn. Honeywell	G-1098D	11
Trim Tab Controller	Pioneer	#15701-R	20
Oil Cooler Assembly	U.A.P.	U8416-MM	12
Oil Cooler Assembly	U.A.P.	U8013-MM	14
Hydraulic Pump	Vickers	MF9-713-15H	120
Hydraulic Pump	Vickers	PF12-713-25BCE	124
Hydraulic Pump	Vickers	PF4-713-20BCE	327
Hydraulic Pump/3000 P.S.I.	Vickers	MF45-3911-20Z	43
Hydraulic Cylinder	Air Associates	HC2109	29
Hydraulic Cylinder	Air Associates	HC2110	8
Fire Detector	Edison	117-47	46
Fire Detector	CO_2 Mfg. Co.	ASDC2	65
CO_2 Cylinders	Kidde	981290	185
CO_2 Cylinders	Kidde	M8700368	47
Anti-Ice Pump	Adel	D7818	125
Auxiliary Power Unit	Eclipse	NEP-2	29
Auxiliary Power Unit	Lawrence	LER-30D	16
Pump	Pesco	1EAR-2808H	15
Pump	Pesco	1E-621	8
Pump	Pesco	2E258SA	21
Separator	Pesco	3V-217-HC	32
Accumulator	Vickers	AA14002A	35
Actuator	Air Associates	M-2031	22
Wobble Pump (D-3)	Erie Meter	AN4014	17
Oxygen Cyl.	Kidde	983748	74
Windshield Wiper Kit	Marquette	K14949E	140

ENGINE ACCESSORIES

Starter	Eclipse	1416-12E	75
Generator	Eclipse (NEA-3A)	716-3A	100
Starter Motor	Jack & Heinz	JH950-R	90
Generator	G.E.	2CM46A2	4
Generator	Eclipse	1003-4	71
Carburetor	Stromberg	PD12K10	550
Carburetor	Stromberg	PR48-A1	236
Carburetor	Holley	1685-HAR	90
Carburetor	Holley	1375-F	19
Magneto	Scintilla	SF9-LN-2	407
Fuel Pump	Pesco	2P248EB	6
Fuel Strainer	U.A.P.	U635A	76
Governor	Woodward	5x18	10
Prop. Reversing Control	Ham. Standard	72400	20
Oil Seperator	Eclipse	564-2A	384
Oil Filter	Purolator	27314	100
Pressure Relief Valve	Aerotec	V301B7	20
Tachometer	Eclipse	2227-11-D3A	11
Vacuum Pump	Eclipse	610-2C	6
Spark Plugs	Aero	LS4-AD1	185,000

AIRCRAFT ENGINES & PARTS

Engine	Wright	R-1820-52	1
Engine	Wright	R-1820-54	16
Engine	Wright	R-1820-60	4
Engine	P & W	R-1830-43	1
Bearing	P & W	1045A	166
Flange	P & W	3506	500
Follower Assy.	P & W	8288	130
Blower Assy.	P & W	3M814	814
Shaft	P & W	48362	53
Shaft	P & W	48363	75
Gear	P & W	48461	390
Gear	P & W	76236	78
Bearing	P & W	84289	1178
Housing	P & W	84487	113
Nose Housing	P & W	84591C	77
Crankcase Assy.	P & W	84350-D	200
Pump Assy.	Wright Aero	420313	33
Drive Assy.	Wright Aero	416421	46
G.E.C. Unit		FM1	36

AIRCRAFT ENGINES & PARTS (Cont.)

Description	Mfg.	Part No.	Quan.
G.E.C. Unit		PY4M(B24)	17
Bearing	Torrington	NR6L12	25790
Bearing	Fafnir	AN200-K3L2	18273

GAUGES

Compass	Eclipse	36001-0	20
Gyro Indicator	Eclipse	14601-1F-B1	11
Gyro Indicator	Eclipse	10078-1AG	62
Position Indicator, Wheel & Flap	Weston	AN5780-2	400
Position Indicator, Wheel & Flap	G.E.	AN5780-2	1000
Position Indicator, Wheel & Flap	Eclipse	20100-11C-4-A1	23
Pitch Trim Gauge	Eclipse	15100-1B-A1	19
Cowl Flap Indicator	G.E.	8DJ29AAY	21
Oil Temp. Indicator	Lewis	77C3	23
Oil Temp. Indicator	Lewis	77C4	13
Oil Temp. Indicator	Weston	828TY13Z2	71
Manifold Pressure Gauge	Manning, Maxwell & Moore	AN5770-2	28
Manifold Pressure Gauge	U.S. Gauge (Metric)	AW2-3/4-25K	146
Fuel Quantity Gauge	Eclipse	3801-3B	128
Dual Carb. Temp. Gauge	Weston	828TY12Z2	40
Carb. Air Temp.	Lewis	77C3	22
Carb. Air Temp.	Weston	119862	40
Air Temp. Gauge	Weston	787TY70Z2	11
Air Temp. Gauge	Weston	787TY79Z2	85
Air Temp. Gauge	Weston	787TY73Z2	88
Air Temp. Gauge	Weston	787TY74Z2	83
Air Temp. Gauge	Weston	788-40Z2	10
Air Temp. Gauge	Weston	787-TY37P	298
Air Temp. Gauge	Lewis	47B22	33
Air Temp. Gauge	Lewis	47B23	28
Air Temp. Gauge	Lewis	47B24	54
Air Temp. Gauge	Lewis	47B21	30
Cylinder Head Temp.	Lewis	76B19	8
Torque Indicator	Eclipse	20100-498-14A2	9
Tachometer Indicator	G.E.	8DJ13ABK	6
Tachometer Indicator	Eclipse	2222-1F-2A	200
Magnesyn Pos. Indicator	Eclipse	20000-8A-14	9
Magnesyn Transmitter	Eclipse	20000-43A-13A1	8
Magnesyn Indicator	Eclipse	23000-2A	67
Pressure Transmitter	Eclipse	22101-11-A4	15
Pressure Transmitter	Giannini	47114-D2.0-20	8
Differential Pressure Gauge	Kollsman	906-6-011	22
Differential Pressure Gauge	Kollsman	254BK-6-052	48

AIRCRAFT (RADIO)

Transmitter	Bendix Radio	TA-12B	20
Receiver	Bendix Radio	RA10-D8	35
Amplifier (PB10) W/ED2 Mount	Eclipse	15401-1	10
Amplifier	Eclipse	12086-1C	11
Radio Noise Filter	G.E.	1C-200	740
Radio Noise Filter	G.E.	NF10084	959
Tube		JAN6AL5	327
Standing Wave Ind.	Hewlett Packard	415A	3
Antenna Switch	Bendix Radio	MS49A	26
Control	Bendix Radio	3616	81
Station Box	Bendix Radio	3620	93
Insulator	Bendix Radio	MT48C	518

ELECTRICAL PARTS

Transformer	Eclipse	DW33	11
Transformer	Eclipse	DW28	80
Transformer	Eclipse	DW47	33
Transformer	G.E.	70G3	26
Servo Motor	Transicoil	#1300-20	57
Motor	G.E.	5BA40NJ1A	425
Motor	G.E.	5DP65-MB1	189
Motor	G.E.	5BA25D-J48	44
Motor	Airesearch	26675	25
Motor	Diehl	FD65-5	21
Circuit Breaker	Spencer	PM-5	2094

ELECTRICAL PARTS (Cont.)

Description	Mfg.	Part No.	Quan.
Circuit Breaker	Spencer	C6363-1-5A	115
Circuit Breaker	Spencer	C6363-1-2A	115
Circuit Breaker	Heinemann	AM1614-80	1700
Circuit Breaker	Cutler Hammer	6141-H69A	237
Amplidyne	G.E.	5AM31JJ9A	31
Amplidyne	G.E.	5AM31NJ10	111
Switch	Kidde	A-4614	151
Ignition Switch	Scintilla	AN3213-1	70
Ignition Switch	Nesco	A-9(94-3226)	250
Master Switch	Jos Pollack	M862A	66
Thermo Switch	Fenwall	17322-2	126
Heater Control Switch	White-Rodgers	1033-4E1	287
Air Ram Switch	Minn. Honeywell	PG208AS1	148
Air Ram Switch	Minn. Honeywell	PG208AS7	40
Pressure Switch	Aerotec	M-101-B	20
Pressure Switch	Eclipse	3135-11C	88
Impact Switch	Kidde	SA/3A	18
Switch	C.H.	8909-K99	2000
Dome Light	Grimes	AN3096-4	2585
Dome Light	Grimes	AN3096-5	775
Dome Light	Grimes	AN3096-6	1365
Plug	Cannon	NAF310310-4B	2747
Plug	Cannon	NAF310310-5B	402
Relay	Leach	7964-404	47
Relay	Leach	7910	24
Relay	Allied	BOBX-2	31
Relay	Square D	8JA	718
Relay	G.E.	CR9791-G100-K4	281
Relay	G.E.	CR9792F101-A3	626
Relay	Guardian	G34464	41
Relay	Guardian	G31502-A	350
Relay	C. P. Clare	D2060	45
Control Box	Vapor Car Heating Co.	9804B	34
Compensator	Vapor Car Heating Co.	468311	95
Solenoid	Interstate Aircraft & Eng. Co.	A812	209
Flex. Cable	Airesearch	25439	66
Temp. Control	Fulton Syphon	715E	59
Noise Filter	Mallory	NF3-5	500
Regulator	G.E.	3GBD1A18A	13

VALVES

Valve	Kidde	982585	326
Valve	Oh. Chem.	AN60009-1B	325
Valve	Oh. Chem.	AN60009-2A	247
Valve (3000 PSI)	Parker	2-1046-78	47
Restrictor Valve	Parker	SP4-2746-77	68
Restrictor Valve	Parker	SP4-2746-78	105
Restrictor Valve	Parker	SP4-2746-79	40
Restrictor Valve	Parker	SP4-2746-80	48
Restrictor Valve	Parker	SP4-2746-81	60
Restrictor Valve	Parker	SP4-2746-76	142
Restrictor Valve	Adel	18784	33
Cone Check Valve	Parker	PL2-2546-75	127
Cone Check Valve	Parker	PL2-2546-76	123
Cone Check Valve	Parker	PL2-2546-77	620
Cone Check Valve	Parker	PL2-2546-78	540
Check Valve	Parker	PLY-843-54	112
Check Valve	Parker	PL2-1846-77	23
Check Valve	Kenyon	19100-2-101B	67
Check Valve	Eclipse	557-5	9
Check Valve	U. S. Gauge	AW-CV-1-1	180
Valve	Parker	6-746-10	68
Valve	Vickers	AA31400	28
Restrictor Valve	Adel	18784	33
Lock Valve	Adel	13924-2	85
Brake Valve	Vickers	146109	22
Selector Valve	Parker	SP-1-445-8	7
Selector Valve	Adel	D9530	478
Selector Valve	Adel	D9530-2	668
Selector Valve	Adel	D9560-2	498
Selector Valve	Adel	D9632	179
Selector Valve	Adel	D9696	237
Selector Valve	Adel	D10044	744
Selector Valve	Adel	D10051	244
Solenoid Valve	United	37D6210 (AN4078-1)	2200
Magnetic Valve	General Control	AV1B1174	114
Throttling Valve		73-A-01	1865
Relief Valve	Airex	1965-900	240
Pressure Relief Valve	Aerotec	V301B7	20
Valve	Aero Supply	74247 (TyPH3)	814
Valve	Whittaker	AN5830-1	335
Valve	Whittaker	AN5830-6	74
Valve	Parker	AN5831-1	60
Valve	Eclipse	612-4A	130
Valve	Kohler	K1593-6D	1988
Valve '0-500PSI)	Bendix	146109	46

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More on Lost Airplanes

A few columns ago (AVIATION WEEK Nov. 30, p. 76), the subject of lost aircraft was broached, with the acknowledgement that it was indeed a touchy subject. That manuscript was written during the first week in November and since then several things have happened to indicate that more on this topic might not be amiss.

For one thing, letters from other pilots indicate that they feel the same way—strongly. One quote from a military pilot puts it nicely: "There was a time when instrument weather provided the comforting thought, 'Only the first team will be out.' However, this no longer seems to be true, and those prop-wash bumps occur more and more frequently. . . ."

▶**Others Agree**—Many other pilots feel the same way. Although the air is "free" to anyone, the abuse of that freedom, either by endangering lives or by causing irresponsible delays to others, is a serious offense.

Another indication of the importance of this topic (actually there were several episodes) occurred during the third week in November—a week which East Coast inhabitants will long remember as the period of the "great smog."

Reduced visibility literally stopped highway traffic during mid-afternoon on some days and night conditions dropped below zero-zero! Obviously air travel approached the vanishing point.

The night of the 21st was particularly bad. At Boston's Logan Airport, the report was 100-ft. ceiling and ¼-mile visibility for several hours. Consequently, scheduled airliners as well as many other ships headed elsewhere. In the midst of the turmoil, there appeared a small plane from Cape Cod and, after being advised of the weather, requested a contact approach!

▶**Another Tragedy**—Since only military and airline flying carries landing restrictions, the tower could not deny this operation. The result was just what could be expected. Two occupants were fished out of the ocean by crash boats, the other went down with the ship.

A similar tragedy took place at La Guardia Field some time that night. A rented lightplane with a pleasure party aboard contacted the tower, learned of the near zero-zero conditions, and was not heard from again. Next morning workmen on the field found the remains of the aircraft and the bodies.

Fortunately—if such a word can be used at this time—these instances concerned only the occupants of those planes. It seems, however, that pilots not only have the obligation of safety for their passengers, but they also have an obligation to conduct a safe flight for the good of the entire aviation world.

Public wrath at accidents does not easily distinguish between types of aircraft, and everyone can suffer accordingly.

▶**Why?**—As stated in the preceding article, cases of mechanical failure, instrument or radio trouble, etc., are not held against the pilot. Failure of the thinking mechanism, however, is quite another matter. The question arises, "Why on earth did these pilots fly into weather like this, much less try to land in it?"

Landings under extreme conditions can't be made safely with multi-engine, multi-pilot, multi-equipped planes; how can it be done with less? Being all too familiar with our sometimes over-regulated industry, this author has always tried to avoid advocating more of the same. Nevertheless, episodes like these are precisely the reason for rule making.

"Qualified" still appears to be the key word. When a pilot willfully enters an area—either weather-wise or geographically speaking—for which he is unprepared, then he is wrong. Somehow this must be prevented.

AVIATION CALENDAR

Jan. 8-11—Florida Air Pilots Assn., 11th annual air cruise, Miami, Fla.

Jan. 10-12—Institute of Surplus Dealers, trade show and convention, Madison Square Garden, New York.

Jan. 12-18—Society of Automotive Engineers, annual meeting, Sheraton-Cadillac and Statler Hotels, Detroit. American Helicopter Society will present a familiarization program and a symposium on copter fatigue problems Jan. 14.

Jan. 18-22—American Institute of Electrical Engineers, winter general meeting, Hotel Statler, New York.

Jan. 20-22—Operations Research in Production and Inventory Control, Case Institute of Technology, Cleveland. Speakers include Paul Stillson of Lockheed Aircraft Corp.

Jan. 25-28—Plant Maintenance & Engineering Show, International Amphitheater, Chicago. Conference will be held during the show period at the Hotel Conrad Hilton.

Jan. 25-29—Institute of the Aeronautical Sciences, 22nd annual meeting, Hotel Astor, New York. Honors Night Dinner, Jan. 25. American Helicopter Society will present papers on transport and military copter design Jan. 25.

Feb. 3-5—Society of Plastics Industry, ninth annual division conference on reinforced plastics, Edgewater Beach Hotel, Chicago.

Feb. 4—Instrument Society of America, ninth annual regional conference, Hotel Statler, New York. Aviation section's papers will include: Afterburner Thrust Measurement in Flight.

Feb. 4-6—Institute of Radio Engineers, sixth Southwestern Conference and Electronics Show, Hotel Tulsa, Tulsa, Okla.

Feb. 18-19—Institute of Radio Engineers and American Institute of Electrical Engineers, transistor circuits conference, Philadelphia.

Feb. 21-23—Third annual Texas Agricultural Aviation Conference, Texas A&M College, College Station, Tex.

Mar. 22-25—Institute of Radio Engineers, national convention, Waldorf-Astoria Hotel and Kingsbridge Armory, New York.

Apr. 5-6—Society of the Plastics Industry (Canada), Inc., 12th annual conference, Mount Royal Hotel, Montreal.

Apr. 19-20—Symposium on automatic production of electronic equipment, sponsored jointly by Stanford Research Institute and USAF, Fairmont Hotel, San Francisco.

Apr. 21-24—Second annual student paper competition for undergraduates and graduates, sponsored by the Texas section of IAS, Melrose Hotel, Dallas.

Apr. 22-23—American Institute of Electrical Engineers, conference on feedback control, Claridge Hotel, Atlantic City, N. J.

Apr. 29-30—American Society of Tool Engineers, 10th biennial industrial exposition, Convention Center, Philadelphia.

May 4-6—1954 Electronic Components Symposium, Department of Interior auditorium, Washington, D. C.

May 5-7—Third International Aviation Trade Show, managed by Aircraft Trade Shows, Inc., 71st Regiment Armory, New York.

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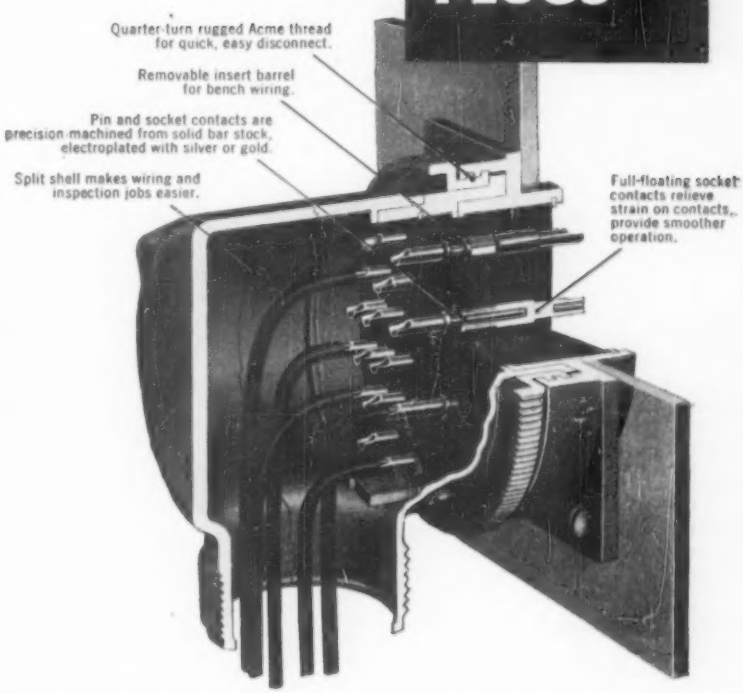
Here's why those in the know –demand

CANNON PLUGS


Quarter-turn rugged Acme thread for quick, easy disconnect.
Removable insert barrel for bench wiring.
Pin and socket contacts are precision-machined from solid bar stock, electroplated with silver or gold.
Split shell makes wiring and inspection jobs easier.
Full-floating socket contacts relieve strain on contacts, provide smoother operation.

Recognition of Cannon's 36 years of sound engineering and fine, uncompromising construction has built the demand for Cannon Plugs. Here we take an inside look at the lightweight Type "K" 90° connector, forerunner of the Army-Navy Series. More features of the "K" were incorporated into the "AN" design than any other connector.

Constantly improved over the years, Type "K" is now used for numerous applications such as aircraft, radio, television, sound, phone recorders, motion pictures, geophysical research and widely used throughout the electro-mechanical and electronic instrument fields.

The design and construction details in the Cannon "K" Series are typical of the care Cannon takes in producing more than 18,000 precision, multi-contact connectors to serve the exacting needs of industry.

We will gladly send you engineering bulletins describing each of the many basic types of Cannon Plugs if you will briefly describe your applications.

Diagram at left shows how the four positions of cable entry on the large 90° "K" endbell make the wiring job easier. Smaller Type "K" connectors have three positions.

CANNON ELECTRIC

Since 1915

Factories in Los Angeles, Toronto, New Haven. Representatives in principal cities. Address inquiries to Cannon Electric Company, Department LL-110, Los Angeles 31, California.

Type "K" and "RK" connectors are available in 7 shell types having 8 diameters. Inserts have more than 190 contact arrangements. Some of these have Coax, Twinax or Thermocouple contacts as standard. Integral cable clamps available in all "K" plug types.

LETTERS

Comets 2 & 3

With reference to your paragraph "BOAC'S Comet Makes Record Flight" in AVIATION WEEK Sept. 28th, 1953: It was not the first production Comet 2 that made the record run to Rio de Janeiro but the Series 2 prototype with Series 1 airframe and Avon engines.

Also your statement to the effect that the rear section of the Comet 3 is sticking out of the DH experimental shop at Hatfield is incorrect. No part of the Comet 3 has at any time up to this date protruded from experimental shop.

However, I should like to take this opportunity of commending you on your interesting aviation magazine which I read every week.

A. CARLTON SMITH
39 Abbots Grove
Stevenage Herts., England

(Nat McKitterick, AVIATION WEEK's correspondent in London, says: "Mr. Smith is correct that it was the Comet 2 prototype, not the first production model, that flew to Rio in September. The prototype was handed to BOAC for route testing as soon as the first production model flew. As to whether the tail protruded, he may be right. When David Anderton and I visited de Havilland, the door of the experimental shop was open and we had a look down the fuselage of the Comet 3."—ED.)

For Business Pilots

I read with interest your article Nov. 30, "Refresher Pilot Training Pays Off in Safety" by Frank Shea, Jr. We, of course, believe Curtiss-Wright manufactures the finest pieces of electronic pilot training equipment in the business. Therefore, when you and your fine magazine put those kind words in print we are appreciative, indeed. Please accept our congratulations for a well-written and informative article about a training program for a group of top-notch pilots who so often take a back seat, publicity-wise, to the Air Force and commercial pilots.

J. V. MICCIO,
Vice President, Electronics Div.
Curtiss-Wright Corp.
Carlstadt, N. J.

Dynes, Not Dienst

It was very gratifying to read your accurate coverage of the United States Air Force Experimental Rocket Engine Test Station in a recent issue of AVIATION WEEK.

The general reaction and feeling towards a magazine article of the type published in AVIATION WEEK is wholeheartedly supported by most Rocket Test and Development people who feel that recently published stories which include "Space Cadets" or "Buck Rogers" sensationalism do not help, but seriously hinder, the understanding of the science of rocket propulsion in the United States.

I would also like to mention that the name of Donald L. Dynes, Chief of our Test Operations Section, was unfortunately misspelled to read D. L. Dienst. Mr. Dynes deserves a large share of credit in the operation of our test stands and instrumentation station.

RICHARD F. GOMPERTZ, Chief
Experimental Rocket Engine Test Station
Edwards Air Force Base, Calif.

Too Plush?

Your Nov. 2 issue reports two more items that all us taxpayers will be glad to know.

• **Page 84,** "Piloting his own AD-4Q radar countermeasures version of the Douglas Skyraider, Rear Adm. Apollo Soucek, Chief of Navy's BuAer, left last week on a two-week inspection tour of aircraft factories located in the West and Midwest."

Would not old-fashion eyesight be less expensive and more practical than an $800,000 flying radar station for inspecting aircraft plants in inland areas? I'd personally pick an airplane with more sponge rubber and a well-stocked buffet for such a tour.

• **Page 33,** ". . . to house F-100 fuselage assemblies . . . a newly built concrete windowless factory building with ventilating system making four complete changes of air an hour!"

For a product that will spend the rest of its life fighting the weather, this is certainly a sterile start. No mention is made of the lighting bill that this "Carlsbad Cavern" will create each month. What's wrong with old-fashion windows and fresh air—both are mighty cheap and readily available? Any fixed-price airplane I've ever seen was engineered and built in a corrugated-tin-and-plenty-of-windows structure.

JOHN T. HALES
Hermosa Beach, Cal.

Titanium-Manganese

One of our engineers has called our attention to an error in the AVIATION WEEK of Sept. 14, p. 58, in a brief article based on a news item submitted to you by us.

The item was a safety notice on proper handling of titanium-manganese alloys in red fuming nitric acid. The story as printed in AVIATION WEEK referred to these alloys erroneously as "titanium-magnesium."

JAMES F. SCHEER, Public Relations
North American Aviation, Inc.
Downey, Calif.

Davis Crash Barrier?

Your article on Runway Arresting Gear was read with great interest.

We would like to invite your attention to the fact that the principle used is strangely similar in every respect to the Davis Barrier which has been in use since early 1949 aboard Essex and Midway Class carriers. The idea of using anchor chain to provide the deceleration cannot quite be considered original as the system has been in use at major Naval and Marine Air Stations for a considerable time. . . .

We wonder when they will "invent" tail hooks and save the wheel fairings and nylon webbing too.

CORKY J. W. WEDGES, LtJg
CHARLES A. LUFF, LtJg
U.S.S. Princeton
Yokosuka, Japan

I am sure someone else must have written in prior to this concerning your article concerning "Crash Barriers for AF, etc."

It appears to be just poor, inaccurate reporting, which normally is not a fault of your magazine. This is the "Davis" barrier that has been employed on carriers since the jet came into operation, tied into the chain system instead of a hydraulic engine.

Incidentally, the chain system has also been long employed by the Navy at its fields to minimize damage to aircraft with landing gear difficulties. In this case the arresting hook was used and the chain pulled out in this manner. If you ever get to Patuxent River you can see these arrangements.

. . . You don't have to correct the statement that Maj. Gen. Brentnall conceived this device, but it might be nice for the record. Rear Adm. W. V. Davis is the father of the nylon barrier tripped by the nose wheel. He was a captain then and Director of Flight Test at Patuxent.

It appears that there are other people in the world besides the Russians who invented everything. Let us keep the record straight. My delay in writing is because we are in the Far East. . . .

JOHN J. HAYWARD, Captain, USN
USS Point Cruz
CUE 119
FPO, San Francisco, Calif.

(This is NOT the Davis Barrier. It was based upon that idea but a number of changes were required to adapt it to USAF use. USAF and the Navy worked closely in developing this barrier. Gen. Brentnall would be the first to give credit to the Navy for both the idea of the Davis Barrier and for the help they gave him in the Far East in gathering the equipment for this barrier. I'm sure that neither USAF nor the writer of AVIATION WEEK's story intended to imply that this was something the Air Force dreamed up out of the blue.—ED.)

We are always very interested by the valuable information contained in your magazine AVIATION WEEK.

In a recent issue we came across a problem we are studying by our own means: "Crash barriers for jet aircraft."

The solution we have reached is very similar to the one described, and we would be interested in having more details . . . to save us dangerous experiments. . . .

G. DREYFUSS
L'Ingenieur des Ponts et Chaussees
Chef de la Section Documentation et Etudes Scientifiques
155 Rue de la Croix-Nivert
Paris, France

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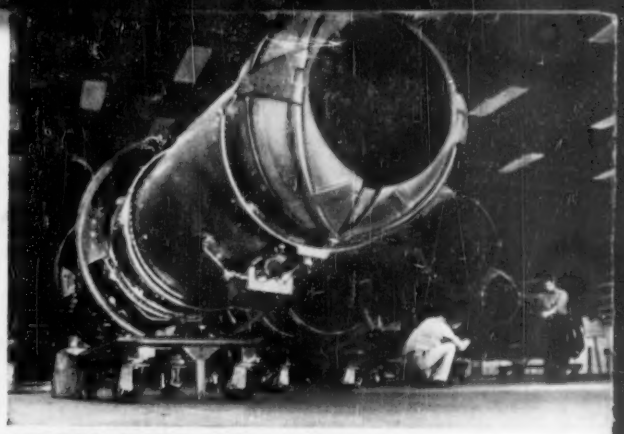
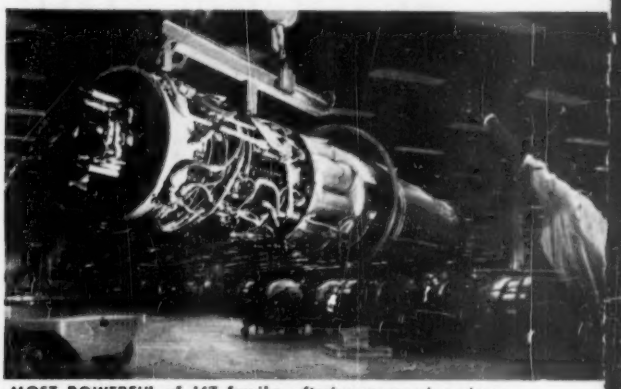


AUTOMATIC CONTROL of the variable area nozzle (illustrated above) regulates exhaust velocity and temperature.



MOST POWERFUL of J47 family, afterburner version gives F-86D Sabre Jet extra power to climb quickly for interception.

Easy-to-operate G-E Jet Engine Lets Pilot Concentrate on Interception

Electronic "Brain" Permits Complete Engine Control with Single Lever

INSTANT BURSTS OF POWER plus simplicity of operation make G.E.'s J47 with afterburner an outstanding powerplant for high-altitude interception. Powering the North American F-86D, America's first one-man rocket-armed interceptor, the afterburner version of the J47 is equipped with automatic electronic controls. For *any* throttle setting, the controls maintain *optimum engine performance under varying flight conditions.* This allows the pilot to focus his attention on his main job—*seeking out enemy aircraft!*

"SENSORS" FEED INFORMATION pertaining to engine pressure and temperature, air temperature, fuel-flow, and other variables into an electronic "brain." The brain compares power needs with engine performance. Adjustments, if necessary, are then made *automatically* as the "brain" controls fuel-flow and variable area nozzle on the afterburner.

AUTOMATIC ENGINE CONTROL is supplemented by other features such as anti-icing provisions which are essential to high-altitude interception. These engineering accomplishments have been factored into the J47 by G.E.'s design, development, and manufacturing organization—an organization that is actively proving that *"Progress is General Electric's most important product." Section 230-13, General Electric Company, Schenectady 5, N. Y.*

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